GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR
An Autonomous Institute | NAAC 'A' Grade Institute | Affiliated to MDU, Rohtak

Ref. No. **GITAM/AC/005/2026/** 203-227 Dated: 24/07/2026

To

All the members of the
Academic Council,
Ganga Institute of Technology and Management, Jhajjar

Subject: Agenda for the 5th meeting of the Academic Council

Sir/Madam,

It is to inform you that 5th meeting of the Academic Council will be held on Wednesday, the 5th August, 2026 at 11:00 A.M. in the Board Room of the Institute. A copy of the agenda is enclosed.

You are requested kindly to make it convenient to attend the meeting.

Encl: As above.

Member Secretary
Academic Council

Endst. No. GITAM/AC/005/2026/ 228-229 Dated: 24/07/2026

Copy to

- Dean College Development Council, MDU Rohtak
- Website In-charge to upload on the website

Member Secretary
Academic Council

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

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GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

AGENDA OF 5TH MEETING OF THE ACADEMIC COUNCIL TO BE HELD ON 05.08.2026 AT 11.00 AM IN THE BOARD ROOM OF THE INSTITUTE

AC 5.1 **Confirmation of the minutes of 4th emergent meeting of the Academic Council held on 25.03.2026.**

To confirm the minutes of 4th emergent meeting of the Academic Council held on 25.03.2026 **(Annexure AC/5.1 Pages 1-14, already circulated).**

AC 5.2 **Follow-up action report on the decisions taken in the 4th emergent meeting of the Academic Council held on 25.03.2026.**

To note the follow-up action on the decisions taken in the 4th emergent meeting of the Academic Council held on 25.03.2026 **(Annexure AC/5.2 Pages 15-16, already circulated)**.

AC 5.3 **To consider the recommendations of the Board of Studies of Electronics and Communication Engineering Department made vide Resolution no. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 30.05.2026 (Annexure AC/5.3 Pages 17-20).**

The Board of Studies of Electronics and Communication Engineering Department vide Resolution no. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 30.05.2026 has recommended the following:

(i) Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Electronics and Communication Engineering) 3rd Year w.e.f. 2026-27 **(Annexure AC/5.4 Pages 21-80).**

(ii) Syllabi of Open Elective Courses offered by Electronics and Communication Engineering Department for B.Tech. 3rd Year (A-Scheme) effective from the Academic Session 2026–27 **(Annexure AC/5.5 Pages 81-84).**

(iii) Scheme of Studies & Examinations and Syllabi of B.Tech (Electronics and Communication Engineering) 2nd year (B-Scheme as per NEP-2020) w.e.f. 2026-27 **(Annexure AC/5.6 Pages 85-146).**

(iv) Scheme of Studies & Examinations of the B.Tech (B-Scheme) Minor Degree, Honours (Hons.) and Specialization in VLSI Design and Technology, along with the syllabi of the 2nd Year, w.e.f. the Academic Session 2026–27 **(Annexure AC/5.7 Pages 147-155)**.

Minor / Hons Degree	To be offered as Hons., Only for following Major Disciplines (For any other Major Discipline which is not mentioned, it may be offered as Minor Degree)
VLSI Design and Technology	Electronics and Communication Engineering

The matter was considered by the Director, who approved the above recommendations and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/018 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Board of Studies of Electronics and Communication Engineering Department as mentioned above for approval.

AC 5.4 **To consider the recommendations of the Board of Studies of Computer Science and Engineering Department made vide Resolution no. 4.3(a-c), 4.4, 4.5 and 4.6 (a-c) of its meeting held on 06.06.2026 (Annexure AC/5.8 Pages 156-160)**

The Board of Studies of Computer Science and Engineering Department vide Resolution No. 4.3 (a-c), 4.4, 4.5 and 4.6 (a-c) of its meeting held on 06.06.2026 has recommended the following:

(i) Scheme of Studies & Examinations and Syllabi (A-Scheme) for 3rd Year
   (a) B.Tech Computer Science and Engineering and B.Tech Computer Science and Engineering for Working Professionals **(Annexure AC/5.9 Pages 161-216).**
   (b) B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning **(Annexure AC/5.10 Pages 217-270).**
   (c) B.Tech Computer Science and Engineering-Data Science effective from the Academic Session 2026–27 **(Annexure AC/5.11 Pages 271-327).**

(ii) Syllabi of Open Elective Courses offered by Computer Science and Engineering Department for B.Tech. 3rd Year (A-Scheme) effective from the Academic Session 2026–27 **(Annexure AC/5.12 Pages 328-329).**

(iii) Scheme of Studies & Examinations and Syllabi (B-Scheme as per NEP-2020) common for 2nd year of B.Tech Computer Science and Engineering, B.Tech Computer Science and Engineering for Working Professionals 2nd Year, B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning and B.Tech Computer Science and Engineering-Data Science effective from the Academic Session 2026–27 **(Annexure AC/5.13 Pages 330-384).**

(iv) Scheme of Studies & Examinations and Syllabi (B-Scheme) for
   (a) Honors (Hons.)/Specialization/Minor Degree in the Cyber Security **(Annexure AC/5.14 Pages 385-402).**
   (b) Minor Degree in the Data Science **(Annexure AC/5.15 Pages 403-420)** and
   (c) Minor Degree in the Artificial Intelligence and Machine Learning effective from Academic Session 2026-27 **(Annexure AC/5.16 Pages 421-438).**

The matter was considered by the Director, who approved the above recommendations and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/019 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Board of Studies of Computer Science and Engineering Department as mentioned above for approval.

AC 5.5 **To consider the recommendations of the Board of Studies of Civil Engineering Department made vide Resolution no. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 06.06.2026 (Annexure AC/5.17 Pages 439-442).**

The Board of Studies of Civil Engineering Department vide Resolution No. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 06.06.2026 has recommended the following:

(i) Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Civil Engineering) 3rd Year w.e.f. 2026-27 **(Annexure AC/5.18 Pages 443-498).**

(ii) Syllabi of Open Elective Courses offered by Civil Engineering Department for B.Tech. 3rd Year (A-Scheme) effective from the Academic Session 2026–27 **(Annexure AC/5.19 Pages 499-502).**

(iii) Scheme of Studies & Examinations and Syllabi of B.Tech (Civil Engineering) and B.Tech (Civil Engineering for Working Professionals) 2nd year (B-Scheme as per NEP-2020) *w.e.f.* 2026-27 **(Annexure AC/5.20 Pages 503-549).**

(iv) Scheme of Studies & Examinations and Syllabi of Minor/Honours Degree Programme in Green Technology & Sustainability Engineering **(Annexure AC/5.21 Pages 550-565).**

The matter was considered by the Director, who approved the above recommendations and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/020 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Board of Studies of Civil Engineering Department as mentioned above for approval.

AC 5.6 **To consider the recommendations of the Board of Studies of Electrical Engineering Department made vide Resolution no. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 08.06.2026 (Annexure AC/5.22 Pages 566-569).**

The Board of Studies of Electrical Engineering Department vide Resolution No. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 08.06.2026 has recommended the following:

(i) Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Electrical Engineering) 3rd Year w.e.f. 2026-27 **(Annexure AC/5.23 Pages 570-624).**

(ii) Syllabi of Open Elective Courses offered by Electrical Engineering Department for B.Tech. 3rd Year (A-Scheme) effective from the Academic Session 2026–27 **(Annexure AC/5.24 Pages 625-626).**

(iii) Scheme of Studies & Examinations and Syllabi of B.Tech (Electrical Engineering) and B.Tech (Electrical Engineering-Working Professionals) 2nd year (B-Scheme as per NEP-2020) *w.e.f.* 2026-27 **(Annexure AC/5.25 Pages 627-682).**

(iv) Scheme of Studies & Examinations and Syllabi of Minor/Honours Degree Programme in Electric Vehicles **(Annexure AC/5.26 Pages 683-697).**

The matter was considered by the Director, who approved the above recommendations and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/021 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Board of Studies of Electrical Engineering Department as mentioned above for approval.

AC 5.7 **To consider the recommendations of the Board of Studies of Fire Technology and Safety Department made vide Resolution no. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 11.06.2026 (Annexure AC/5.27 Pages 698-701).**

The Board of Studies of Fire Technology and Safety Department vide Resolution No. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 11.06.2026 has recommended the following:

(i) Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Fire Technology and Safety) and B.Tech (Fire Technology and Safety-Working Professionals) 3rd Year w.e.f. 2026-27 **(Annexure AC/5.28 Pages 702-769).**

(ii) Syllabi of Open Elective Courses offered by Fire Technology and Safety Department for B.Tech. 3rd Year (A-Scheme) effective from the Academic Session 2026–27 **(Annexure AC/5.29 Pages 770-773).**

(iii) Scheme of Studies & Examinations and Syllabi of B.Tech (Fire Technology and Safety) and B.Tech (Fire Technology and Safety-Working Professionals) 2nd year (B-Scheme as per NEP-2020) *w.e.f.* 2026-27 **(Annexure AC/5.30 Pages 774-835).**

(iv) Proposal to start the Minor/Honours Degree Programme in Sustainable Energy Engineering (SEE) along with the Scheme of Studies & Examinations and Syllabi **(Annexure AC/5.31 Pages 836-878)** The eligible students to opt for the same are as given below:

Minor / Hons Degree	To be offered as Hons., Only for following Major Disciplines (For any other Major Discipline which is not mentioned, it may be offered as Minor Degree)
Sustainable Energy Engineering (SEE)	Applicable to any discipline of Engineering and Technology

The matter was considered by the Director, who approved the above recommendations and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/022 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Board of Studies of Fire Technology and Safety Department as mentioned above for approval.

AC 5.8 **To consider the recommendations of the Board of Studies of Mechanical Engineering Department made vide Resolution no. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 16.06.2026 (Annexure AC/5.32 Pages 879-882).**

The Board of Studies of Mechanical Engineering Department vide Resolution No. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 16.06.2026 has recommended the following:

(i) Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech Mechanical Engineering 3rd Year w.e.f. 2026-27 **(Annexure AC/5.33 Pages 883-941).**

(ii) Scheme of Studies & Examinations and Syllabi (B-Scheme) of B.Tech Mechanical Engineering 2nd year *w.e.f.* 2026-27 **(Annexure AC/5.34 Pages 942-996).**

(iii) Scheme of Studies & Examinations and Syllabi of the Minor/Honours Degree Programme or Specialization in Robotics **(Annexure AC/5.35 Pages 997-1013).**

(iv) Syllabi of Open Elective Courses offered by Mechanical Engineering Department for B.Tech. 3rd Year (A-Scheme) effective from the Academic Session 2026–27 **(Annexure AC/5.36 Pages 1014-1017).**

Minor / Hons Degree	To be offered as Hons., Only for following Major Disciplines (For any other Major Disciplines which is not mentioned, it may be offered as Minor Degree)
Robotics	Mechanical Engineering, Electrical Engineering and Electronics & Communication Engineering

The matter was considered by the Director, who approved the above recommendations and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/023 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Board of Studies of Mechanical Engineering Department as mentioned above for approval.

AC 5.9 **To consider the recommendations of the Board of Studies of Computer Science and Applications Department made vide Resolution no. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 30.05.2026 (Annexure AC/5.37 Pages 1018-1022).**

The Board of Studies of Computer Science and Applications Department vide Resolution No. 4.3, 4.4, 4.5 and 4.6 of its meeting held on 30.05.2026 has recommended the following:

(i) Revisions in MCA Software Laboratories (Software Lab 1 to Software Lab 8 and Bridge Course Lab), Dissertation –I Evaluation Criteria, Dissertation – II Evaluation Criteria and PT Evaluation Criteria *w.e.f.* 2026-27 **(Annexure AC/5.38 Pages 1023-1058).**
(ii) Scheme of Examinations and Syllabi of BCA 3rd year (A-Scheme) *w.e.f.* 2026-27 **(Annexure AC/5.39 Pages 1059-1116).**
(iii) Revised Credit Structure, Scheme of Studies & Examinations and Syllabi of BCA 1st Year *w.e.f.* 2026-27 **(Annexure AC/5.40 Pages 1117-1181).**
(iv) Scheme of Examinations and Syllabi of BCA 2nd Year (B-Scheme) *w.e.f.* 2026-27 **(Annexure AC/5.41 Pages 1182-1249).**

The matter was considered by the Director, who approved the above recommendations and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/024 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Board of Studies of Computer Science and Applications Department as mentioned above for approval.

AC 5.10 **To consider the recommendations of the Board of Studies of Management Department made vide Resolution no. 4.3, 4.4, 4.6 and 4.7 of its meeting held on 05.06.2026 (Annexure AC/5.42 Pages 1250-1253).**

The Board of Studies of Management Department vide Resolution No. 4.3, 4.4, 4.6 and 4.7 of its meeting held on 05.06.2026 has recommended the following:

(i) Scheme of Examinations for the BBA, BBA (Honours) and BBA (Honours with Research) Programmes from the 5th Semester to 8th

Semester and Syllabus for the 3rd Year of the BBA (A-Scheme) from the Academic Session 2026-27 **(Annexure AC/5.43 Pages 1254-1286).**

(ii) Revised Scheme of Examinations for the BBA, BBA (Honours) and BBA (Honours with Research) Programmes from 1st to 8th Semester and Syllabus for the 1st Year and 2nd Year of the BBA (B-Scheme) from the Academic Session 2026-27 **(Annexure AC/5.44 Pages 1287-1319).**

(iii) Proposal to Start the Certificate Course on "Data Analysis using Excel" from Academic Session 2026-27 **(Annexure AC/5.45 Pages 1320-1322).**

(iv) Minor Changes in the note in the Syllabus

Existing Note	Amended Note
At least four cases will be discussed, one from each unit.	At least four cases will be discussed in the classroom. However, the examiner may ask not more than one case-based question in the examination.

The matter was considered by the Director, who approved the above recommendations and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/025 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Board of Studies of Management Department as mentioned above for approval.

AC 5.11 **To consider the recommendations of Academic Planning and Execution Committee of the Institute made vide Resolution No. 1, 2 and 3 of its meeting held on 20.05.2026 (Annexure AC/5.46 Pages 1323-1325).**

The Academic Planning and Execution Committee of the Institute vide Resolution No. 1 and 2 of its meeting held on 20.05.2026 has recommended the following:

(i) The proposal to start the B.Tech in Civil Engineering, B.Tech in Electrical Engineering, M.Tech in Structural Design, and MCA (as supernumerary seats) for working professionals from the Academic Year 2026-27, modalities and guidelines, Infrastructure and Faculty requirements as per AICTE guidelines.

The Institute was granted approval for running of following undergraduate and postgraduate Programmes for working professionals from AICTE vide letter no. F. No. North-West/1-46223043271/2026/EOA dated 10.04.2026 **(Annexure AC/5.47 Pages 1326-1331)**

Level	Programme	Course	Approved Intake 2026-27
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	CIVIL ENGINEERING	30
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRICAL ENGINEERING	30
POST GRADUATE	ENGINEERING AND TECHNOLOGY	STRUCTURAL DESIGN	15
POST GRADUATE	COMPUTER APPLICATIONS	MCA	30

And as per Clause 10.2 (Page No. 15) of UGC regulations for Autonomous college (Gazetted notification) "An autonomous college is free to start a new degree programme(s) at undergraduate and postgraduate levels with the approval of the Academic Council of the Autonomous College and concerned Statutory Council(s), wherever required, provided the nomenclature of the degree is in consonance with UGC Notification on Specification of Degrees, 2014 as amended from time to time. Such courses shall fulfill the minimum standards prescribed by the parent university/UGC/Statutory Council(s) in terms of number of hours, curricular content and standards, and the parent University shall be duly informed of such courses" **(Annexure AC/5.48 Pages 1332).**

(ii) Preparation of the modalities and guidelines for running the Programmes for Working Professionals

The Academic Planning and Execution Committee discussed the modalities and AICTE guidelines for running the Programmes for Working Professionals in AICTE approved Institutions vide Circular No. AICTE/P&AP/APII/2023-24/01 dated 24.08.2023 and Circular No. AICTE/RB/Misc./2023-24 Dated 21.03.2024 **(Annexure AC/5.49 Pages 1333-1335).** The modalities and guidelines for running the Programmes for Working Professionals shall be the same as those approved by the Academic Council in its 3rd meeting held on 03.07.2025, in accordance with AICTE guidelines. However, the qualification to take admission in M.Tech Structural Design and MCA Programmes will be as follows:

Qualification

(a) **M.Tech Structural Design:** B.E./B.Tech or other equivalent degree in Civil Engineering or in any other relevant discipline with 50% (47.50% Marks for SC/ST candidates of Haryana only) Marks in aggregate.

(b) **MCA:** Passed BCA/B.Sc. (Hons.) Computer Science/B.E. or B.Tech. (CSE/IT)/B.Voc.(Software Development/IT) or an equivalent degree with having at least 50% marks (45% for SC/ST candidates of Haryana only) in aggregate.

OR

Passed B.Sc./B.Com./B.A. with Mathematics at 10+2 level or at Graduation level with having at least 50% marks (45% for SC/ST candidates of Haryana only) in aggregate, along with the students admitted with this eligibility will have to simultaneously undertake additional *bridge course as prescribed by the Institute during the first semester.

Note: * It is compulsory for each student to pass the bridge course (three additional theory papers and one practical as prescribed in the Scheme of Examinations of bridge course) as per Institute norms during the 1st year of MCA-2 Year Programme. However, these bridge course papers will be taught only in the 1st semester of the Programme.

(iii) Academic Calendar for the Academic Session 2026-27.

The Academic Planning and Execution Committee of the Institute vide Resolution No. 3 of its meeting held on 20.05.2026 approved the Academic Calendar for the Academic Year 2026-27 **(Annexure AC/5.50 Page 1336).**

The committee recommended the items mentioned at (i)-(iii) to the Academic Council for approval.

The matter was considered by the Director, who approved the above recommendations mentioned at (i)-(iii) and further ordered that the same are to be taken up in the next meeting of Academic Council for approval. The same has been notified to the Academic Planning and Execution Committee vide letter No. GITAM/ACAD/DR/2026/026 dated 20.07.2026.

The Academic Council may consider the action taken by the Director on the recommendations of the Academic Planning and Execution Committee as mentioned above for approval.

AC 5.12 **To consider the recommendations of the Controller of Examinations regarding approval of Panel of Examiners for Theory/Practical Examinations**

The Board of Studies of all departments approved the Panel of Examiners for Theory/Practical Examinations for Academic Session 2026-27 and submitted the same to the Controller of Examinations **(Annexure AC/5.51 Pages 1337-1378).** The Controller of Examinations recommended the same to the Director of the Institute.

The matter was considered by the Director, who approved the Panel of Examiners recommended by the concerned Board of Studies and submitted by the Controller of Examinations and further ordered that the same is to be taken up in the next meeting of Academic Council for approval.

The Academic Council may consider the action taken by the Director on the recommendations of the Controller of Examinations as mentioned above for approval.

AC 5.13 **To consider the recommendations of the Chairperson BOS Applied Science and Humanities regarding approval of subject expert in the Board of studies in place of Dr. Divyajyoti Singh, Professor, J.C. Bose University of Science and Technology, YMCA (Formerly YMCA UST).**

The chairperson Board of Studies Applied Science and Humanities received an email from Dr. Divyajyoti Singh, regarding looking for an alternative in the Board of Studies due to her responsibilities and hence unavailability to attend the meetings of Board of Studies **(Annexure AC/5.52 Pages 1379-1380).**

The matter was considered by the Director and further ordered that the same is to be taken up in the next meeting of the Academic Council for Approval.

The Academic Council may consider the action taken by the Director on the recommendations of the Chairperson Board of Studies, Applied Science and Humanities as mentioned above for approval.

AC 5.14 **Any other item with the permission of the Chair**

Registrar

Annexure AC/5.1

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR
An Autonomous Institute| NAAC 'A' Grade Institute | Affiliated to MDU, Rohtak

MINUTES OF THE 4TH EMERGENT MEETING OF THE ACADEMIC COUNCIL HELD ON 25.03.2026 AT 03.00 PM IN THE BOARD ROOM OF THE INSTITUTE

Members Present

1.	Prof. Aman Aggarwal	Chairperson Director, GITAM
2.	Prof. Yudhvir Singh	Member (University Nominee)
3.	Prof. Rajeev Kumar	Member (University Nominee)
4.	Prof. Seema Singh	Member (University Nominee)
5.	Prof. Gian Bhushan	Member (Academia)
6.	Mr. Rajesh Sharma	Member (Industry Expert) Online
7.	Dr. Anurag Jain	Member
8.	Dr. Punam Devi	Member
9.	Dr. Rakesh Joon	Member
10.	Dr. Nitin Kumar	Member
11.	Dr. Jitender Kumar	Member
12.	Mr. Joginder Singh	Member
13.	Mr. Vivek	Member
14.	Mr. Jitender Singh	Member
15.	Ms. Sheela Malik	Member
16.	Ms. Suman Singh	Member
17.	Dr. Dipika	Member
18.	Dr Hari Parshad	Member
19.	Ms. Upasna	Member
20.	Mr. Parvesh	Member
21.	Dr. Hitanshu Saluja	Member
22.	Dr. Vivek Arora	Member Secretary

At the outset, the Director, GITAM welcomed the members to the 4th Meeting of the Academic Council. After that, with due permission of the chair, the agenda was taken up by the Registrar.

AC 4.1 **Confirmation of the minutes of 3rd meeting of the Academic Council held on 03.07.2025.**

To confirm the minutes of 3rd meeting of the Academic Council held on 03.07.2025 **(Annexure 4.1 Pages 1-9, already circulated).**

RESOLVED THAT THE MINUTES OF 3RD MEETING OF THE ACADEMIC COUNCIL HELD ON 03.07.2025 (ANNEXURE 4.1 PAGES 1-9, ALREADY CIRCULATED) BE CONFIRMED.

AC 4.2 **Follow-up action report on the decisions taken in the meeting of the Academic Council held on 03.07.2025.**

To note the follow-up action on the decisions taken by the Academic Council in the meeting held on 03.07.2025 **(Annexure 4.2 Pages 10-11, already circulated).**

RESOLVED THAT THE FOLLOW-UP ACTION REPORT ON THE DECISIONS TAKEN IN THE 3RD MEETING OF THE ACADEMIC COUNCIL HELD ON 03.07.2025 (ANNEXURE 4.2 PAGES 10-11, ALREADY CIRCULATED) BE NOTED.

AC 4.3 **A) Ratification of the action taken by the Director in approving the recommendations of Board of Studies of Fire Technology and Safety made vide Resolution No. 3.3 (Annexure 4.3 Pages 12-15, already circulated), in anticipation of the approval of Academic Council, regarding introduction of**

(i) Specialization/Minor Degree in Industrial Safety *w.e.f.* 2025-26 (Even Sem) with Scheme of Examinations and Syllabus of Industrial Safety Engineering (MFTIS201A) to be taught in 4th Semester (Annexure 4.4 Pages 16-19, already circulated).

(ii) Hons/Specialization/Minor Degree in Disaster Management *w.e.f.* 2025-26 (Even Sem) with Scheme of Examinations and Syllabus of Emergency Response and Management of Disasters (MFTDM201A) to be taught in 4th Semester (Annexure 4.5 Pages 20-22, already circulated).

B) Consideration of the recommendations of the Board of Studies of Fire Technology and Safety Department made vide Resolution no. 3.3 of its meeting held on 22.12.2025 regarding

(i) **Scheme of Examination and Syllabus of Specialization/Minor Degree in Industrial Safety (5th Semester onwards) (Annexure 4.6 Pages 23-40, already circulated).**

(ii) **Scheme of Examination and Syllabus of Hons/ Specialization/Minor Degree in Disaster Management (5th Semester onwards) (Annexure 4.7 Pages 41-55, already circulated).**

The Board of Studies of Fire Technology and Safety Department vide Resolution No. 3.3 of its meeting held on 22.12.2025 has approved the Scheme of Examinations and Syllabus of Specialization/Minor Degree in Industrial Safety and Hons/ Specialization/Minor Degree in Disaster Management and the eligible students to opt for the same are as given below:

Name of the Minor/Honors (Hons.)/Specialization Degree	B.Tech Program whose students are eligible to opt for Minor Degree	B.Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization
Industrial Safety	All Branches except Fire Technology and Safety	---------
Disaster Management	All Branches except Fire Technology and Safety, Civil Engineering	Fire Technology and Safety, Civil Engineering

The matter was considered by the Director, who approved the above recommendations in the interest of the students to introduce the Specialization/ Minor Degree in Industrial Safety and Minor/Specialization/Hons. Degree in Disaster Management *w.e.f.* 2025-26 (Even Sem) (with approval of one course to be taught in 4th Semester), in anticipation of approval of the Academic Council as the meeting of the Academic Council was not likely to be held soon and the matter was urgent and further ordered that the courses to be taught from 5th Semester onwards of Specialization/Minor Degree in *Industrial Safety*, and Hons./Specialization/Minor Degree in *Disaster Management* are to be taken up in the meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/001 dated 01.01.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE AT (A) (i)-(ii) BE RATIFIED AND AT (B) (i)-(ii) BE APPROVED.

[ACTION BY REGISTRAR]

AC 4.4 (A) **Ratification of the action taken by the Director in approving the recommendations of Board of Studies of Mechanical Engineering made vide Resolution no. 3.4 and 3.5 of its meeting held on 27.12.2025 (Annexure 4.8 Pages 56-59, already circulated), in anticipation of the approval of Academic Council, regarding**

(i) Introduction of Hons/Specialization/Minor Degree in Robotics *w.e.f.* 2025-26 (Even Sem) with Scheme of Examinations and Syllabus of Introduction to Robotics (MMER202A) to be taught in 4th Semester (Annexure 4.9 Pages 60-64, already circulated).

(ii) Minor correction in the Course Title of B. Tech Mechanical Engineering 2nd Year.

Course Code	Existing Course Title	Corrected Course Title
PEC-ME-216A	CNC Machining	CNC Technology

(B) **Consideration of the recommendations of the Board of Studies of Mechanical Engineering Department made vide Resolution no. 3.3 and 3.4 of its meeting held on 27.12.2025 regarding**

(i) Scheme of Examinations and Syllabus of Minor Degree/Honors (Hons.)/Specialization in "Robotics" from 5th sem onwards from Academic Session 2026-27 (Annexure 4.10 Pages 65-78, already circulated) and the eligible students to opt for the same are as given below:

Name of the Minor/Honors (Hons.)/Specialization Degree	B.Tech Program whose students are eligible to opt for Minor Degree	B.Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization
Robotics	All Branches except Mechanical Engineering, Electronics and Communication Engineering, Electrical Engineering	Mechanical Engineering, Electronics and Communication Engineering, Electrical Engineering

(ii) Scheme of Examinations and Syllabus of Certificate Course on "CNC Machines and Part Programming" from Academic Session 2026-27 (Annexure 4.11 Pages 79-81, already circulated).

The Board of Studies of Mechanical Engineering vide Resolution No. 3.3, 3.4 and 3.5 of its meeting held on 27.12.2025 has recommended

(a) Scheme of Examination and Syllabus of Hons/Specialization/Minor Degree in Robotics *w.e.f.* 2025-26 (Even Sem).
(b) Scheme of Examinations and Syllabus of Certificate Course on "CNC Machines and Part Programming" from Academic Session 2026-27.

(c) Minor correction in the Course Title of B. Tech Mechanical Engineering 2nd Year.

The matter was considered by the Director, who approved the above recommendations in the interest of the students mentioned at (A)(i)-(ii) in anticipation of approval of the Academic Council as the meeting of the Academic Council was not likely to be held soon and the matter was urgent and further ordered that the courses of Hons. Degree in Robotics to be taught from 5th Semester onwards and certificate course mentioned at (B)(i)-(ii) are to be taken up in the meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/015 dated 05.01.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE AT (A) (i)-(ii) BE RATIFIED AND THE RECOMMENDATIONS OF THE BOARD OF STUDIES OF MECHANICAL ENGINEERING DEPARTMENT MENTIONED AT (B) (i)-(ii) BE APPROVED.

[ACTION BY REGISTRAR]

AC 4.5 (A) **Ratification of the action taken by the Director in approving the recommendations of Board of Studies of Electronics and Communication Engineering made vide Resolution no. 3.3 of its meeting held on 27.12.2025 (Annexure 4.12 Pages 82-85, already circulated), in anticipation of the approval of Academic Council, regarding Introduction of Hons/Specialization/Minor Degree in VLSI Design and Technology *w.e.f.* 2025-26 (Even Sem) with Scheme of Examinations and Syllabus of Digital Design with Verilog (MECEVLSI201A) to be taught in 4th Semester (Annexure 4.13 Pages 86-89, already circulated).**

(B) **Consideration of the recommendations of the Board of Studies of Electronics and Communication Engineering Department made vide Resolution no. 3.3 and 3.4 of its meeting held on 27.12.2025 regarding**

(i) Scheme of Examinations and Syllabus of Minor Degree/Honors (Hons.)/Specialization in "VLSI Design and Technology" from 5th sem onwards from Academic Session 2026-27 (Annexure 4.14 Pages 90-104, already circulated) and the eligible students to opt the same are as given below:

Name of the Minor/Honors (Hons.)/Specialization Degree	B.Tech Program whose students are eligible to opt for Minor Degree	B.Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization
VLSI Design and Technology	All Branches except ECE	ECE

(ii) Scheme of Examinations and Syllabus of Certificate Course on "IOT Fundamentals and its Applications" from Academic Session 2026-27 (Annexure 4.15 Pages 105-108, already circulated).

The Board of Studies of Electronics and Communication Engineering vide Reso. No. 3.3 and 3.4 of its meeting held on 27.12.2025 recommended the

(a) Scheme of Examinations and Syllabus of Minor/ Honors (Hons.)/ Specialization in VLSI Design and Technology from Academic Session 2025-26.

(b) Scheme of Examinations and Syllabus of Certificate Course on "IOT Fundamentals and its Applications" from Academic Session 2026-27.

The matter was considered by the Director, who approved the above recommendations in the interest of the students mentioned at (A) in anticipation of approval of the Academic Council as the meeting of the Academic Council was not likely to be held soon and the matter was urgent and further ordered that the courses of Hons. Degree in VLSI Design and Technology to be taught from 5th Semester onwards and other item mentioned at (B) (i)-(ii), are to be taken up in the meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/013 dated 05.01.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE AT (A) BE RATIFIED AND THE RECOMMENDATIONS OF THE BOARD OF STUDIES OF ECE DEPARTMENT MENTIONED AT (B) (i)-(ii) BE APPROVED.

[ACTION BY REGISTRAR]

AC 4.6 (A) **Ratification of the action taken by the Director in approving the recommendations of Board of Studies of Computer Science and Engineering made vide Resolution no. 3.4 and 3.5 of its meeting held on 27.12.2025 (Annexure 4.16 Pages 109-113, already circulated), in anticipation of the approval of Academic Council, regarding**

(i) Introduction of Hons/Specialization/Minor Degree in "Cyber Security" *w.e.f.* 2025-26 (Even Sem) with Scheme of Examinations and Syllabus of Information Security Fundamentals (MCSE202A) to be taught in 4th Semester (Annexure 4.17 Pages 114-118, already circulated).

(ii) Introduction of Hons/Specialization/Minor Degree in "Data Science" *w.e.f.* 2025-26 (Even Sem) with Scheme of Examinations and Syllabus of Mathematics for DS (MDS202A) to be taught in 4th Semester (Annexure 4.18 Pages 119-123, already circulated).

(iii) Introduction of Hons/Specialization/Minor Degree in "Artificial Intelligence and Machine Learning" *w.e.f.* 2025-26 (Even Sem) with Scheme of Examinations and Syllabus of Mathematics for AI (MAIML202A) to be taught in 4th Semester (Annexure 4.19 Pages 124-128, already circulated).

(iv) Amendment in the Course Objectives and Course Outcomes for Course Code (PCC-CSE-210A) of 4th Sem.

B) **Consideration of the recommendations made by the Board of Studies of Computer Science and Engineering vide Resolution no. 3.3 and 3.4 of its meeting held on 27.12.2025 regarding**

(i) **Scheme of Examinations and Syllabus of Certificate Course on "Generative Artificial Intelligence" from Academic Session 2026-27 (Annexure 4.20 Pages 129-134, already circulated).**

(ii) **Scheme of Examinations and Syllabus (5th Semester onwards) of Minor/ Honors (Hons.)/ Specialization Degree in "Cyber Security" (Annexure 4.21 Pages 135-148, already circulated).**

(iii) **Scheme of Examinations and Syllabus (5th Semester onwards) of Minor Degree in "Data Science" (Annexure 4.22 Pages 149-162, already circulated).**

(iv) **Scheme of Examinations and Syllabus of (5th Semester onwards) of Minor Degree in "Artificial Intelligence and Machine Learning" (Annexure 4.23 Pages 163-176, already circulated).**

Name of the Minor/Honors (Hons.)/Specialization Degree	B.Tech Program whose students are eligible to opt for Minor Degree	B.Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization
Cyber Security	All Branches except Computer Science and Engineering, CSE (Data Science), CSE (Artificial Intelligence and Machine Learning)	Computer Science and Engineering, CSE (Data Science), CSE (Artificial Intelligence and Machine Learning)
Data Science	All Branches except Computer Science and Engineering, Computer Science and Engineering (Data Science), Computer Science and Engineering (Artificial Intelligence and Machine Learning)	-------
Artificial Intelligence and Machine Learning	All Branches except Computer Science and Engineering, Computer Science and Engineering (Data Science), Computer Science and Engineering (Artificial Intelligence and Machine Learning)	-------

The Board of Studies of Computer Science and Engineering vide Reso. No. 3.3, 3.4 and 3.5 of its meeting held on 27.12.2025 recommended:

(a) Scheme of Examinations and Syllabus of Certificate Course on "Generative Artificial Intelligence" from Academic Session 2026-27.
(b) Scheme of Examinations and Syllabus of Minor/ Specialization/ Hons. Degree in "Cyber Security".
(c) Scheme of Examinations and Syllabus of Minor Degree in "Data Science"
(d) Scheme of Examinations and Syllabus of Minor Degree in "Artificial Intelligence and Machine Learning".
(e) Amendment in the Course Objectives and Course Outcomes for Course Code (PCC-CSE-210A) of 4th Sem.

Course Code PCC-CSE-210A	
Existing Course Objectives	**Revised Course Objectives**
The objectives of this course are • To introduce Python programming basics, including syntax, data types, and control structures. • To develop skills in Python data structures, functions, and recursion.	The objectives of this course are • To introduce the fundamental concepts, history, and problem-solving nature of artificial intelligence. • To provide an understanding of core AI techniques for search, knowledge representation, reasoning, planning, and learning.

• To explore Python's graphical programming, image processing, and GUI development. • To explain object-oriented programming, exception handling, and multithreading concepts.	• To develop the ability to apply appropriate AI methods to solve representative computational problems. • To familiarize students with modern AI systems, expert systems, neural networks, and emerging trends in artificial intelligence.
Existing Course Outcomes	**Revised Course Outcomes**
CO1: Recall fundamental Python programming concepts including syntax, data types, control structures, functions, object-oriented principles, and multithreading. **CO2:** Explain the use of Python data structures, file operations, graphical libraries, and GUI components for developing structured programs. **CO3:** Solve real life problem by developing Python programs using logic, functions, graphics, OOP, and multithreading. **CO4:** Analyze programming constructs and design techniques for efficient Python applications.	**CO1:** Define fundamental concepts of artificial intelligence, problem characteristics, knowledge representation, learning paradigms, and current AI trends. **CO2:** Explain search strategies, knowledge representation schemes, reasoning under uncertainty, planning approaches, and learning methods used in artificial intelligence. **CO3:** Apply appropriate AI techniques such as search algorithms, logical reasoning, probabilistic methods, and learning models to solve representative AI problems. **CO4:** Analyze AI problems to select suitable problem-solving, reasoning, planning, or learning approaches and evaluate their effectiveness.

The matter was considered by the Director, who approved the above recommendations in the interest of the students mentioned at (A) (i)-(iv) in anticipation of approval of the Academic Council as the meeting of the Academic Council was not likely to be held soon and the matter was urgent and further ordered that the recommendations mentioned at (B) (i)-(iv) are to be taken up in the meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/011 dated 05.01.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE AT (A) (i)-(iv) BE RATIFIED AND THE RECOMMENDATIONS OF THE BOARD OF STUDIES OF COMPUTER SCIENCE AND ENGINEERING DEPARTMENT MENTIONED AT (B) (i)-(iv) BE APPROVED.

[ACTION BY REGISTRAR]

AC 4.7 (A) **Ratification of the action taken by the Director in approving the recommendations of Board of Studies of Electrical Engineering Department made vide Resolution no. 3.4 and 3.5 of its meeting held on 26.12.2025 (Annexure 4.24 Pages 177-181, already circulated), in anticipation of the approval of Academic Council, regarding**

(i) Introduction of Hons/Specialization/Minor Degree in "Electric Vehicles" w.e.f. 2025-26 (Even Sem) with Scheme of Examinations and Syllabus of Fundamentals of Electric Vehicle (MEEEV202A) to be taught in 4th Semester (Annexure 4.25 Pages 182-185, already circulated).

(ii) Minor correction in the Course outcomes of two courses of B. Tech Electrical Engineering 2nd Year from Academic Session 2025-26.

(B) **Consideration of the recommendations made by the Board of Studies of Electrical Engineering Department vide Reso. No. 3.3 and 3.4 of its meeting held on 26.12.2025 regarding**

(i) Scheme of Examinations and Syllabus of Certificate Course on "Solar PV Installation and Maintenance" from Academic Session 2026-27 (Annexure 4.26 Pages 186-188, already circulated).

(ii) Scheme of Examinations and Syllabus (5th Semester onwards) of Minor Degree/Honors (Hons.)/Specialization in "Electric Vehicles" from Academic Session 2026-27 (Annexure 4.27 Pages 189-200, already circulated).

The Board of Studies of Electrical Engineering Department vide Reso. No. 3.3, 3.4 and 3.5 of its meeting held on 26.12.2025 recommended the

(a) Scheme of Examinations and Syllabus of Certificate Course on "Solar PV Installation and Maintenance" from Academic Session 2026-27.
(b) Scheme of Examinations and Syllabus of Minor Degree/Honors (Hons.)/Specialization in "Electric Vehicles" from Academic Session 2025-26 (Even Sem).

Name of the Minor/Honors (Hons.)/Specialization Degree	B.Tech Program whose students are eligible to opt for Minor Degree	B.Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization
Electric Vehicles	All Branches except Electrical Engineering, Mechanical Engineering	Electrical Engineering, Mechanical Engineering

(c) Minor correction in the Course outcomes of two courses of B. Tech Electrical Engineering 2nd Year from Academic Session 2025-26.

Course Code PCC-EE-201A	
Existing Course Outcomes	**Revised Course Outcomes**
• CO1: Understand the working principles and I-V characteristics of semiconductor devices such as diodes, BJTs, and MOSFETs. • CO2: Explain and evaluate the ideal and practical characteristics of operational amplifiers (OP-AMPs). • CO3: Apply power amplifiers and voltage regulators for the use of efficient power management in analogue circuits. • CO4: Analyse the process, principles and characteristics of operational amplifiers and IC fabrication for designing electronic circuits and the effect of different feedback topologies on amplifier parameters.	• CO1: State the basic concepts and characteristics of the P–N junction diode, rectifiers, and Zener diode, and recall the clipping and clamping circuits along with the basic structure and I–V characteristics of BJT and MOSFET. • CO2: Explain the working principles of RC, LC, and crystal oscillators using Barkhausen criterion, and describe the operation efficiency, and distortion characteristics of various classes of power amplifiers. • CO3: Apply operational amplifier concepts to design and implement integrator, differentiator, and other basic OP-AMP circuits considering

	non-ideal parameters and frequency response. • CO4: Analyze linear and non-linear OP-AMP applications and feedback amplifier topologies to evaluate gain, stability, bandwidth, and performance of electronic circuits

Course Code PCC-EE-209A	
Existing Course Outcomes	**Revised Course Outcomes**
• CO1: Understand the factors influencing resistivity and explain electron motion in an electric field for electrical conductivity in metals. • CO2: Explain dielectric polarization, dielectric constant, and their effects on capacitors and monatomic gases. • CO3: Analyze dielectric losses, loss tangent, and their frequency and temperature dependence on dielectric materials. • CO4: Understand and differentiate the types of magnetism in magnetic materials.	• CO1: Describe the factors influencing resistivity and electron motion in an electric field for electrical conductivity in metals. • CO2: Explain dielectric polarisation, dielectric constant, and their effects on capacitors and monatomic gases. • CO3: Illustrate the types of magnetism in magnetic materials. • CO4: Analyze dielectric losses, loss tangent, and their frequency and temperature dependence on dielectric materials.

The matter was considered by the Director, who approved the above recommendations in the interest of the students mentioned at (A) (i)-(ii) in anticipation of approval of the Academic Council as the meeting of the Academic Council was not likely to be held soon and the matter was urgent and further ordered that the recommendations mentioned at (B) (i)-(ii) are to be taken up in the meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/007 dated 02.01.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE AT (A) (i)-(ii) BE RATIFIED AND THE RECOMMENDATIONS OF THE BOARD OF STUDIES OF ELECTRICAL ENGINEERING DEPARTMENT MENTIONED AT (B) (i)-(ii) BE APPROVED.

[ACTION BY REGISTRAR]

AC 4.8 (A) Ratification of the action taken by the Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Civil Engineering Department made vide Resolution no. 3.4 of its meeting held on 23.12.2025 (Annexure 4.28 Pages 201-204, already circulated), regarding introduction of Hons/Specialization/Minor Degree in "Green Technology and Sustainability Engineering" *w.e.f.* 2025-26 (Even Sem) with the Scheme of Examinations and Syllabus of Environmental Impact Assessment (GTSE-202A) to be taught in 4th Semester (Annexure 4.29 Pages 205-208, already circulated).

(B) Consideration of the recommendations made by the Board of Studies of Civil Engineering Department vide Reso. No. 3.3 and 3.4 of its meeting held on 23.12.2025 regarding

(i) Scheme of Examinations and Syllabus of Certificate Course on "Building Drawing, Drafting and Quantity Estimation" from Academic Session 2026-27 (Annexure 4.30 Pages 209-211, already circulated).

(ii) **Scheme of Examinations and Syllabus (5th Semester onwards) of Minor Degree/Honors (Hons.)/Specialization in "Green Technology and Sustainability Engineering" from Academic Session 2026-27 (Annexure 4.31 Pages 212-224, already circulated).**

The Board of Studies of Civil Engineering Department vide Reso. No. 3.3 and 3.4 of its meeting held on 23.12.2025 recommended the

(a) Scheme of Examinations and Syllabus of Certificate Course on "Building Drawing, Drafting and Quantity Estimation" from Academic Session 2026-27.
(b) Scheme of Examinations and Syllabus of Minor Degree/Honors (Hons.)/Specialization in "Green Technology and Sustainability Engineering" from Academic Session 2025-26.

Name of the Minor/Honors (Hons.)/Specialization Degree	**B.Tech Program whose students are eligible to opt for Minor Degree**	**B.Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization**
Green Technology and Sustainability Engineering	All Branches except Civil Engineering	Civil Engineering

The matter was considered by the Director, who approved the above recommendations in the interest of the students mentioned at (A) in anticipation of approval of the Academic Council as the meeting of the Academic Council was not likely to be held soon and the matter was urgent and further ordered that the recommendations mentioned at (B) (i)-(ii) are to be taken up in the meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/005 dated 02.01.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE AT (A) BE RATIFIED AND THE RECOMMENDATIONS OF THE BOARD OF STUDIES OF CIVIL ENGINEERING DEPARTMENT MENTIONED AT (B) (i)-(ii) BE APPROVED.

[ACTION BY REGISTRAR]

AC 4.9 **Ratification of the action taken by Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Applied Science and Humanities vide Resolution No. 3.3 and 3.4 of its meeting held on 11.02.2026 (Annexure 4.32 Pages 225-228, already circulated) regarding**

(i) **Examination Pattern (Examiner note for Paper Setting) (Annexure 4.33 Page 229, already circulated).**
(ii) **Minor correction in the Syllabus, Course Code, Course Objectives and Course Outcomes of Engineering Mathematics-III for B.Tech Electrical Engineering 4th Semester (Annexure 4.34 Pages 230-234, already circulated).**

The Board of Studies of Applied Science and Humanities vide Reso. No. 3.3 and 3.4 of its meeting held on 11.02.2026 recommended the

(a) Examination Pattern (Examiner note for Paper Setting)
(b) Minor correction in the Syllabus, Course Code, Course Objectives and Course Outcomes of Engineering Mathematics-III for B.Tech Electrical Engineering 4th Sem.

The matter was considered by the Director, who approved the above recommendations in anticipation of the approval of Academic Council and ordered to put it in the meeting of Academic Council for ratification. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/017 dated 16.02.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE BE RATIFIED.

[ACTION BY REGISTRAR]

AC 4.10 (A) **Ratification of the action taken by Director, in anticipation of approval of Academic Council, in approving the recommendations of the Board of Studies of Management Department made vide Resolution No. 3.3, 3.5 (b), (c) of its meeting held on 26.12.2025 (Annexure 4.35 Pages 235-240, already circulated) regarding**

(i) Scheme of Examinations and Syllabus of 4th Semester of MBA Programme (A-Scheme) (Annexure 4.36 Pages 241-349, already circulated).
(ii) Scheme of Examinations and Syllabus of 4th Semester of BBA Programme (A-Scheme) (Annexure 4.37 Pages 350-373, already circulated).
(iii) Scheme of Examinations and Syllabus of 2nd Semester of BBA (B-Scheme) (Annexure 4.38 Pages 374-395, already circulated).

(B) **Consideration of the recommendations made by the Board of Studies of Management made vide Resolution No. 3.5 (a) and 3.7 (a)-(b) of its meeting held on 26.12.2025 regarding**

(i) Amendment in Credit Structure and Course Category under A-Scheme BBA, BBA (Honours), BBA (Honours with Research) for students admitted in 2024-25.

(ii) Scheme of Examinations and Syllabus of Certificate Course on "Digital Marketing" from Academic Session 2026-27 (Annexure 4.39 Pages 396-398, already circulated)

(iii) Scheme of Examinations and Syllabus of Certificate Course on "Tally ERP 9" from Academic Session 2026-27 (Annexure 4.40 Pages 399-401, already circulated).

The Board of Studies of Management vide Reso. No. 3.3, 3.5 (a)-(c) and 3.7 (a)-(b) of its meeting held on 26.12.2025 recommended the

(a) Scheme of Examinations and Syllabus of 4th Semester of MBA Programme from Academic Session 2025-26 (A-Scheme).
(b) Amendment in Credit Structure and Course Category under Scheme-A (BBA, BBA (Honours), and BBA (Honours with Research).

Existing Credit Structure of the BBA (A-Scheme) Program				
Sr. No.	Category	Breakup of Credits		
		BBA	BBA (H)	BBA (With Research)
1	Discipline-Specific Courses (DSC) /Major Course	76	116	104
2	Minor (MIC)/ Minor Vocational (MICV)/ Skill Enhancement Courses (SEC)/Internship	37	45	45
3	Multidisciplinary Courses	09	09	09
4	Ability Enhancement Course	08	08	08
5	Value Added Course	06	06	06
6	Research Project/Dissertation			12
	Total Credits	**136**	**184**	**184**

Amended credit structure of the BBA (A-Scheme) Program				
Sr. No.	Category	Breakup of Credits		
		BBA	BBA (H)	BBA (Honors with Research)
1	Discipline-Specific Courses (DSC)/Major Course	76	116	104
2	Minor (MIC)/ Minor Vocational (MICV)/ Skill Enhancement Courses (SEC)/Internship	37	45	45
3	Multidisciplinary Courses	09	09	09
4	Ability Enhancement Course	08	08	08
5	Value Added Course	06	06	06
6	Research Project/Dissertation	04	04	16
	Total Credits	**140**	**188**	**188**

(c) Scheme of Examinations and Syllabus of BBA 4th semester (A-Scheme).
(d) Scheme of Examinations and Syllabus of 2nd Semester BBA (B-Scheme).
(e) Scheme of Examinations and Syllabus of Certificate Course on "Digital Marketing" from Academic Session 2026–27.
(f) Scheme of Examinations and Syllabus of Certificate Course on "Tally ERP 9" from Academic Session 2026–27.

The matter was considered by the Director, who approved the above recommendations mentioned at (A) (i)-(iii) in anticipation of approval of the Academic Council as the meeting of the Academic Council was not likely to be held soon and the matter was urgent and further ordered that the recommendations mentioned at (B) (i)-(iii) are to be taken up in the meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/009 dated 02.01.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE AT (A) (i)-(iii) BE RATIFIED AND THE RECOMMENDATIONS OF THE BOARD OF STUDIES OF MANAGEMENT DEPARTMENT MENTIONED AT (B) (i)-(iii) BE APPROVED.

[ACTION BY REGISTRAR]

AC 4.11 (A) **Ratification of the action taken by Director, in anticipation of approval of Academic Council, in approving the recommendations of Board of Studies of Computer Science and Applications Department vide Resolution No. 3.4 (a)-(b) (Annexure 4.41 Pages 402-406, already circulated) regarding**

(i) Revised Scheme of Examinations of BCA Syllabus of 4th Semester Value Added Course, Major Discipline Relevant Course (Vocational)- Minor (A-Scheme) *w.e.f.* 2025-26 (Annexure 4.42 Pages 407-425, already circulated).

(ii) Scheme of Examinations and Syllabus of BCA 2nd Semester (B-Scheme) (Annexure 4.43 Pages 426-447, already circulated).

(B) **Consideration of the recommendations made by the Board of Studies of Computer Science and Applications vide Resolution No. 3.3 of its meeting held on 22.12.2025 regarding (Annexure 4.44 Pages 448-457, already circulated).**

The Board of Studies of Computer Science and Applications vide Reso. No. 3.3 and 3.4 (a)-(b) of its meeting held on 22.12.2025 recommended the

(a) Scheme of Examinations and Syllabus of Certificate Courses on "Blockchain Application Development" and "Web Development & Marketing" from Academic Session 2026-27.

(b) Revised Scheme of Examinations of BCA 2nd year and syllabus of Ability Enhancement Course, Value Added Course, Discipline Specific Course-Minor Course and Major Discipline Relevant Course (Vocational)–Minor Course (A-Scheme) *w.e.f.* 2025-26.

(c) Approval of the Scheme of Examinations and Syllabus of BCA 2nd semester (B Scheme) w.e.f 2025-26.

The matter was considered by the Director, who approved the above recommendations mentioned at (A) (i)-(ii) in anticipation of approval of the Academic Council as the meeting of the Academic Council was not likely to be held soon and the matter was urgent and further ordered that the recommendation mentioned at (B) are to be taken up in the meeting of Academic Council for approval. The same has been notified to the department concerned vide letter No. GITAM/ACAD/DR/2026/003 dated 01.01.2026.

The Academic Council considered the above; and

RESOLVED THAT THE ACTION TAKEN BY DIRECTOR MENTIONED ABOVE AT (A) (i)-(ii) BE RATIFIED AND THE RECOMMENDATIONS OF THE BOARD OF STUDIES OF COMPUTER SCIENCE AND APPLICATIONS DEPARTMENT MENTIONED AT (B) BE APPROVED.

[ACTION BY REGISTRAR]

AC 4.12 **Any other item with the permission of Chair**

(A) **The appointment of the Academic Incharge to maintain the records of the Academic Council meeting and to notify the decisions regarding Academic matters approved by Director or Academic Council.**

The Academic Council regularly conducts the meetings to deliberate and approve various academic matters. For effective documentation, record maintenance, and timely communication of decisions, it is proposed to appoint an Academic Incharge. The

designated person will ensure proper recording of minutes, safe custody of records and circulation of approved decisions to all concerned stakeholders.

The Academic Council considered the above; and

RESOLVED THAT THE DIRECTOR OF THE INSTITUTE IS AUTHORIZED TO APPOINT THE ACADEMIC INCHARGE FOR THE ABOVE MENTIONED PURPOSE.

[ACTION BY REGISTRAR]

(B) **To authorize the Director to approve the Panel of Examiners or to take decision related to exams**

The approval of the Panel of Examiners and timely decision-making in examination-related matters are essential for the smooth and efficient conduct of examinations. In order to avoid delays and ensure administrative efficiency, it is proposed to authorize the Director to approve the Panel of Examiners and to take appropriate decisions pertaining to examination processes, in accordance with the rules and regulations of the Institute.

The Academic Council considered the above; and

RESOLVED THAT THE DIRECTOR OF THE INSTITUTE IS AUTHORIZED TO TAKE APPROPRIATE DECISIONS PERTAINING TO EXAMINATION PROCESSES, IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE INSTITUTE.

The meeting ended with the vote of thanks to the Chair.

Registrar

APPROVED

Annexure AC/5.2

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

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Report of the follow-up action on the decisions taken by the Academic Council in its 4th meeting held on 25.03.2026.

Reso. No.	Particulars	Follow-up action taken
AC 4.1	Confirmation of the minutes of 3rd meeting of the Academic Council held on 03.07.2025.	The minutes of 3rd meeting of the Academic Council were confirmed.
AC 4.2	Follow-up action report on the decisions taken in the meeting of the Academic Council held on 03.07.2025.	The Council noted the follow-up action.
AC 4.3	A) Ratification of the action taken by the Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Fire Technology and Safety made vide Resolution no. 3.3 of its meeting held on 22.12.2025. B) Consideration of the recommendations of the Board of Studies of Fire Technology and Safety Department made vide Resolution no. 3.3 of its meeting held on 22.12.2025.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.
AC 4.4	A) Ratification of the action taken by the Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Mechanical Engineering made vide Resolution no. 3.4 and 3.5 of its meeting held on 27.12.2025. B) Consideration of the recommendations of the Board of Studies of Mechanical Engineering Department made vide Resolution no. 3.3 and 3.4 of its meeting held on 27.12.2025.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.
AC 4.5	A) Ratification of the action taken by the Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Electronics and Communication Engineering made vide Resolution no. 3.3 of its meeting held on 27.12.2025. B) Consideration of the recommendations of the Board of Studies of Electronics and Communication Engineering Department made vide Resolution no. 3.3 and 3.4 of its meeting held on 27.12.2025.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.
AC 4.6	A) Ratification of the action taken by the Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Computer Science and Engineering made vide Resolution no. 3.4 and 3.5 of its meeting held on 27.12.2025. B) Consideration of the recommendations made by the Board of Studies of Computer Science and Engineering vide Resolution no. 3.3 and 3.4 of its meeting held on 27.12.2025.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.

AC 4.7	A) Ratification of the action taken by the Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Electrical Engineering Department made vide Resolution no. 3.4 and 3.5 of its meeting held on 26.12.2025. B) Consideration of the recommendations made by the Board of Studies of Electrical Engineering Department vide Reso. No. 3.3 and 3.4 of its meeting held on 26.12.2025.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.
AC 4.8	A) Ratification of the action taken by the Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Civil Engineering Department made vide Resolution no. 3.4 of its meeting held on 23.12.2025. B) Consideration of the recommendations made by the Board of Studies of Civil Engineering Department vide Reso. No. 3.3 and 3.4 of its meeting held on 23.12.2025.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.
AC 4.9	Ratification of the action taken by Director, in anticipation of the approval of Academic Council, in approving the recommendations of Board of Studies of Applied Science and Humanities vide Resolution No. 3.3 and 3.4 of its meeting held on 11.02.2026.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.
AC 4.10	A) Ratification of the action taken by Director, in anticipation of approval of Academic Council, in approving the recommendations of the Board of Studies of Management Department made vide Resolution No. 3.3, 3.5 (b), (c) of its meeting held on 26.12.2025. B) Consideration of the recommendations made by the Board of Studies of Management made vide Resolution No. 3.5 (a) and 3.7 (a)-(b) of its meeting held on 26.12.2025.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.
AC 4.11	A) Ratification of the action taken by Director, in anticipation of approval of Academic Council, in approving the recommendations of Board of Studies of Computer Science and Applications Department vide Resolution No. 3.4 (a)-(b) of its meeting held on 22.12.2025. B) Consideration of the recommendations made by the Board of Studies of Computer Science and Applications vide Resolution No. 3.3 of its meeting held on 22.12.2025.	Decision conveyed to all concerned. The Scheme of Examinations and Syllabus of the said programmes have been uploaded on the Institute website.
AC 4.12	A) The appointment of the Academic Incharge to maintain the records of the Academic Council meeting and to notify the decisions regarding Academic matters approved by Director or Academic Council. B) To authorize the Director to approve the Panel of Examiners or to take decision related to exams.	Director appointed the Academic Incharge to Mr. Vivek HOD, ME and Additional Incharge to Dr. Jitender Kumar, HOD FTS. Decision conveyed to all concerned.

Annexure AC/5.3

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR
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MINUTES OF 4TH MEETING OF THE BOARD OF STUDIES OF ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT HELD ON 30.05.2026 AT 11:00 AM IN THE CONFERENCE HALL OF THE INSTITUTE

The 4th Meeting of the Board of Studies of Electronics and Communication Engineering Department was held on 30th May, 2026 at 11:00 A.M in the conference hall of the Institute.

The following members were present for the BoS meeting:

S. No.	Name of the Member	Affiliation/Organisation	Designation with in BOS
1	Dr. Rakesh Kumar Joon	Professor & Head, ECE, GITAM, Kablana	Chairperson
2	Dr. Manoj Taleja	Subject Expert (Professor-NIT, Delhi), Outside parent university	Member
3	Dr. Sunil Mathur	Subject Expert (Professor-MAIT, Delhi), Outside parent university	Member
4	Dr. Pardeep Sangwan	Subject Expert (Professor-MSIT, Delhi), Outside parent university	Member
5	Dr. Vivek Kumar	Professor, ECE, GITAM Kablana	Member
6	Dr. Hitanshu	Professor, ECE, GITAM Kablana	Member
7	Dr. Nitin Kumar	Professor, ECE, GITAM Kablana	Member
8	Mr. Amit Dalal	Assisstant Professor, ECE, GITAM Kablana	Member
9	Mr. Satish	Assisstant Professor, ECE, GITAMKablana	Member
10	Ms. Lalina	Assisstant Professor, ECE, GITAM Kablana	Member
11	Ms. Gagan Preet	Assisstant Professor, ECE, GITAM Kablana	Member
12	Ms. Ritu Juneja	Assisstant Professor, ECE, GITAM Kablana	Member
13	Mr. Vishal	Assisstant Professor, ECE, GITAM Kablana	Member
14	Ms. Sonia Arora	Assisstant Professor, ECE, GITAM Kablana	Member
15	Ms.Anita	Assisstant Professor, ECE, GITAM Kablana	Member
16	Mr. Dhruv Malik	Assisstant Professor, ECE, GITAM Kablana	Member
17	Mr. Bhushan Chand Aggarwal	Assisstant Professor, ECE, GITAM Kablana	Member
18	Ms. Deepanshi	Assisstant Professor, ECE, GITAM Kablana	Member
19	Ms. Ritu Devi	Assisstant Professor, ECE, GITAM Kablana	Member
20	Ms. Ritu Rana	Assisstant Professor, ECE, GITAM Kablana	Member
21	Mr. Devender Nath Maurya	Industry/ Corporate Sector	Member
22	Mr. Nishant Dev Rathi	Alumni	Member

At the outset, the Chairperson welcomed all the members and thanked them for their valuable presence. The agenda items were taken up for discussion as follows:

Item No. 4.1: Confirmation of the minutes of 3rd meeting of the Board of Studies of Electronics and Communication Engineering Department held on 27.12.2025.

To confirm the minutes of 3rd meeting of the Board of Studies of Electronics and Communication Engineering Department held on 27.12.2025 **(Annexure 4.1 Pages 1-3, already circulated).**

RESOLVED THAT THE MINUTES OF 3RD MEETING OF THE BOARD OF STUDIES OF ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT HELD ON 27.12.2025 (ANNEXURE 4.1 PAGES 1-3, ALREADY CIRCULATED) BE CONFIRMED.

Item No. 4.2: Follow-up action report on the decisions taken in the 3rd meeting of the Board of Studies of Electronics and Communication Engineering Department held on 27.12.2025.

To note the follow-up action on the decisions taken in the 3rd meeting of the Board of Studies of Electronics and Communication Engineering Department in the meeting held on 27.12.2025 **(Annexure 4.2 Page 4, already circulated).**

RESOLVED THAT THE FOLLOW-UP ACTION REPORT ON THE DECISIONS TAKEN IN THE 3RD MEETING OF THE BOARD OF STUDIES OF ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT HELD ON 27.12.2025 (ANNEXURE 4.2 PAGE 4, ALREADY CIRCULATED) BE NOTED.

Item No. 4.3: Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Electronics and Communication Engineering) 3rd Year w.e.f. 2026-27 (Annexure 4.3 Pages 05-64).

The Scheme of Studies & Examinations and Syllabi (A-Scheme) for the 2nd Year of B.Tech. (Electronics and Communication Engineering) was approved by the Board of Studies of Electronics and Communication Engineering Department in its meeting held on 24th May, 2025 and subsequently approved by the Academic Council. The proposed Scheme of Studies & Examinations and Syllabi for the 3rd Year, *w.e.f.* the academic session 2026–27, is placed before the Board as **Annexure 4.3 Pages 5–64.**

The Board of Studies may consider and approve the proposed Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Electronics and Communication Engineering) of 3rd year.

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (A-SCHEME) OF B.TECH (ELECTRONICS AND COMMUNICATION ENGINEERING) OF 3RD YEAR (ANNEXURE 4.3 PAGES 5–64).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item No. 4.4: Syllabi of Open Elective Courses offered by Electronics and Communication Engineering Department for B.Tech. 3rd Year (Scheme-A) effective from the Academic Session 2026–27 (Annexure 4.4 Pages 65-68).

To approve the syllabi of the Open Elective Courses offered by Electronics and Communication Engineering Department for B.Tech. 3rd Year (Scheme-A) **(Annexure 4.4 Pages 65-68)** effective from the Academic Session 2026–27.

Sr. No.	Course Code	Course	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
3	--------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

RESOLVED THAT THE SYLLABI OF OPEN ELECTIVE COURSES OFFERED BY ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT AS MENTIONED ABOVE FOR B.TECH. 3RD YEAR (SCHEME-A), EFFECTIVE FROM THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.4 PAGES 65-68) BE APPROVED.

FURTHER RESOLVED THAT THE APPROVED SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item No. 4.5: Scheme of Studies & Examinations and Syllabi of B.Tech (Electronics and Communication Engineering) 2nd year (B-Scheme as per NEP-2020) *w.e.f.* 2026-27 (Annexure 4.5 Pages 69-130).

The Institute implemented NEP-2020 *w.e.f.* 2025-26 (For 1st Year). The Scheme of Studies & Examinations and Syllabi have been proposed accordingly for 2nd year common to the B.Tech (Electronics and Communication Engineering) **(Annexure 4.5 Pages 69-130).** The revised scheme shall be designated as the B-Scheme in accordance with NEP-2020.

The Board of Studies may consider and approve the Scheme of Studies & Examinations and Syllabi (B-Scheme) for 2nd year of B.Tech (Electronics and Communication Engineering).

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (B-SCHEME) FOR B.TECH (ELECTRONICS AND COMMUNICATION ENGINEERING) (ANNEXURE 4.5 PAGES 69–130).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item No. 4.6: Scheme of Studies and Examinations of B.Tech. (B-Scheme) Minor Degree, Honors (Hons.), and Specialization in VLSI Design and Technology, and Syllabi for 2nd Year w.e.f. Academic Session 2026–27 (Annexure 4.6 Pages 131-139).

The Board of Studies of the Department of Electronics and Communication Engineering, in its meeting held on 27 December, 2025, approved the introduction of the Minor Degree/Honors (Hons.)/Specialization Programme in VLSI Design and Technology with a view to enhancing

employability and imparting in-depth knowledge in emerging areas not covered in the regular curriculum. The proposal was subsequently approved by the Academic Council.

The proposed Scheme of Studies & Examinations and Syllabi for the 2nd Year of the B.Tech. (B-Scheme) Minor Degree, Honors (Hons.), and Specialization in VLSI Design and Technology, to be implemented with effect from the Academic Session 2026–27, is placed before the Board as **Annexure 4.6 (Pages 131–139)**.

The Board of Studies may consider and approve the proposed Scheme of Studies & Examinations and Syllabi for 2nd Year of the B.Tech. (B-Scheme) Minor Degree, Honors (Hons.), and Specialization in VLSI Design and Technology.

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES AND EXAMINATIONS OF B.TECH. (B-SCHEME) MINOR DEGREE, HONORS (HONS.), AND SPECIALIZATION IN VLSI DESIGN AND TECHNOLOGY, AND SYLLABI FOR 2ND YEAR W.E.F. ACADEMIC SESSION 2026–27 (ANNEXURE 4.6 PAGES 131-139).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI OF 2ND YEAR OF MINOR/HONOURS DEGREE PROGRAMME IN VLSI DESIGN AND TECHNOLOGY IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item No. 4.7: Panel of Examiners for Theory and Practical Examinations of B.Tech. Programme for Academic Session 2026-27(Annexure 4.3 Pages 140-142).

The Board of Studies, in its meeting held on 27th Dec., 2025 vide its Resolution No. 3.5, approved the Panel of Examiners. The Board of Studies may now review the existing panel to ensure the inclusion of additional eligible and qualified examiners, if required, to further strengthen the evaluation process for the upcoming academic year **(Annexure 4.7 Pages 140-142).**

RESOLVED THAT THE BOARD OF STUDIES REVIEWED AND APPROVED THE PANEL OF EXAMINERS FOR THEORY AND PRACTICAL EXAMINATIONS FOR THE ACADEMIC SESSION 2026–27(ANNEXURE 4.7 PAGES 140-142).

FURTHER RESOLVED THAT THE APPROVED PANEL BE FORWARDED TO THE CONTROLLER OF EXAMINATIONS FOR FURTHER NECESSARY ACTION.

Item No. 4.8: Any other item with the permission of chair.

There being no other item for discussion, the meeting concluded with a vote of thanks to the Chair.



Dr. Rakesh Kumar Joon
Chairperson, Board of Studies
Department of Electronics and Communication Engineering
Ganga Institute of Technology and Management, Jhajjar

Annexure AC/ 5.4

~~Annexure 4.5~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)
An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme & Syllabus for 3rd Year

Bachelor of Technology Electronics & Communication Engineering

A - SCHEME

(Academic Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

DEFINITION OF CREDIT

1	1 Hr. Lecture (L) per week	1 Credit
2	1 Hr. Tutorial (T) per week	1 Credit
3	2 Hr. Practical (Lab) per week	1 Credit
4	2 Hr. Project per Week	1 Credit

1. RANGE OF CREDIT

A range of credits from 160 to 170 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credit. These could be acquired through MOOCs.

2. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	**Category**	**Breakup of Credits**
1	Professional Core Courses	69
2	Professional Elective Courses (Relevant to chosen specialization/branch)	12
3	Multidisciplinary Open Elective Courses	09
4	Basic Science Courses	21
5	Engineering Science Courses	25
6	Humanities and Social Sciences including Management courses	12
7	Training/Seminar/Internship/Project	19
8	Value Added Courses	3
9	Mandatory Courses	Non-Credit
	Total Credits	**170**

3. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses (Theory Courses)	PCC
2	Professional Core Courses (Lab Courses)	LC
3	Professional Elective Courses (Relevant to chosen specialization/branch)	PEC
4	Multidisciplinary Open Elective Courses	OEC
5	Basic Science Courses	BSC
6	Engineering Science Courses	ESC
7	Humanities and Social Sciences including Management courses	HSMC
8	Training	PT
9	Seminar	SM
10	Internship	INT
11	Project	PROJ
12	Value Added Courses	VAC
13	Mandatory Courses (Non Credit)	MC

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech (Electronics & Communication Engineering) – 5th Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Lectures per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in Hours
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ECE-301A	Electromagnetic & Microwave Engineering	3	0	0	3	3	40	60	-	100	3
2	Professional Core courses	PCC-ECE-303A	Communication Engineering	3	1	0	4	4	40	60	-	100	3
3	Professional Core courses	PCC-ECE-305A	Control System Engineering	3	1	0	4	4	40	60	-	100	3
4	Professional Core courses	PCC-ECE-307A	Computer Organization & Architecture	3	0	0	3	3	40	60	-	100	3
5	Professional Core courses	PCC-ECE-309A	Measurement, Instrumentation & Sensors	3	0	0	3	3	40	60	-	100	3
6	Professional Elective Courses	Refer to Annexure II	Professional Elective (Table–II)	3	0	0	3	3	40	60	-	100	3
7	Professional Core Courses	LC-ECE-321A	Measurement, Instrumentation & Sensors Lab	0	0	2	2	1	25	-	25	50	-
8	Professional Core Courses	LC-ECE-323A	Electromagnetic & Microwave Engineering Lab	0	0	2	2	1	25	-	25	50	-
9	Training	*PT-ECE-325A	Practical Training–I	0	0	2	2	1	25	-	25	50	-
10	Project	PROJ-327A	Mini Project -I	0	0	2	2	1	25	-	25	50	-
Total Credits								**24**				**800**	

Note 1:*PT-ECE-325A:-The evaluation will be based on seminar, viva-voce and report submitted by the students. Students must secure the prescribed minimum passing marks to successfully complete the course. Those who fail to obtain the minimum passing marks shall be required to repeat Practical Training–I.

Note 2: Students must choose one course from the Professional Elective–II category (Table 2). They may also opt for Massive Open Online Courses (MOOCs) offered through SWAYAM, SWAYAM Plus, or NPTEL platforms subject to approval by the concerned Chairperson, Board of Studies (BoS)/Head of the Department.

Annexure-II
Professional Elective Courses (Table-II)

S. No	Course Code	Course Name
1	PEC-ECE-311A	Introduction to MEMS
2	PEC-ECE-313A	VHDL & Digital Design
3	PEC-ECE-315A	Speech and Audio Processing
4	PEC-ECE-317A	Introduction to Artificial Intelligence
5	PEC-ECE-319A	Wireless Sensor Network
6	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech (Electronics & Communication Engineering) – 6th Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Lectures per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in Hours
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ECE-302A	Digital Signal Processing	3	1	0	4	4	40	60	-	100	3
2	Professional Core Courses	PCC-ECE-304A	Antenna & Wave Propagation	3	1	0	4	4	40	60	-	100	3
3	Professional Core Courses	PCC-ECE-306A	CMOS Design	3	0	0	3	3	40	60	-	100	3
4	Professional Core Courses	PCC-ECE-308A	Advance Mobile Communication Technologies	3	0	0	3	3	40	60	-	100	3
5	Professional Elective Courses	Refer to Annexure-III	Professional Elective (Table–III)	3	0	0	3	3	40	60	-	100	3
6	Open Elective Courses	Refer to Annexure-III	Open Elective (Table –IV)	3	0	0	3	3	40	60	-	100	3
7	Professional Core Courses	LC-ECE-320A	Digital Signal Processing Lab	0	0	2	2	1	25	-	25	50	-
8	Professional Core Courses	LC-ECE-322A	CMOS Design Lab	0	0	2	2	1	25	-	25	50	-
9	Project	PROJ-324A	Mini Project - II	0	0	2	2	1	25	-	25	50	-
10	Seminar	SM-ECE-326A	Seminar	0	0	2	2	1	50	-	-	50	-
Total Credits								**24**				**800**	

Note 1: At the end of 6th semester each student has to undergo Practical Training of 6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.

Note 2: Students must choose one course from the Professional Elective–III category (Table III) and one course from the Open Elective–I category (Table IV). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Annexure-III

Professional Elective Courses (Table-III)

S. No	Course Code	Course Name
1	PEC-ECE-310A	Fiber Optic Communication
2	PEC-ECE-312A	High speed electronics
3	PEC-ECE-314A	Adaptive Signal Processing
4	PEC-ECE-316A	Wireless Communication
5	PEC-ECE-318A	Telecommunication & Switching Network
6	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Open Elective Courses - 1 (Table-IV)

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

Course Code	**PCC-ECE-301A**				
Category	Professional Core Courses				
Course Title	**ELECTROMAGNETIC & MICROWAVE ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are to • To introduce fundamentals of microwave engineering, waveguides, and transmission line concepts. • To study microwave components, ferrite devices, and classical microwave tubes with performance analysis. • To understand solid-state microwave devices and their applications in modern systems. • To study electrostatics, transmission lines, and electromagnetic wave propagation with energy flow analysis				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to:

COs	Skills Demonstrated
CO1	Differentiate various waveguide propagation modes used in microwave systems for efficient signal transmission.
CO2	Apply various techniques for measuring parameters of microwave signals to optimize the performance of microwave devices.
CO3	Identify and explain the working operations of microwave components used for transmitting the microwave signal.
CO4	Analyze the impact of microwave systems on electromagnetic compatibility and human safety.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Electrostatics:** Introduction to electric fields, Gauss law and applications, electrostatic potential and energy density, Equations of voltage and current on TX line, Propagation constant and characteristic impedance. **Electromagnetic Wave Propagation** Wave equations in media, plane waves, Reflection and refraction at interfaces (including Brewster angle, critical angle, total internal reflection), Poynting vector.

Unit-II	**Waveguides:** Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI, EMC, comparison with transmission lines, rectangular wave guide, TE & TM modes, cutoff frequency, dominant mode, characteristic impedance, introduction to circular waveguides and planar transmission lines .
Unit-III	**Microwave Components**: Directional couplers, tees, S-parameters, attenuators, cavity resonators (Q-factor, bandwidth), mixers & detectors, matched Load and Ferrite devices, Isolators, circulators. **Microwave Tubes**: Active microwave tubes, Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT, Noise figure and gain analysis of microwave tubes.
Unit-IV	**Microwave Solid State Devices**: Schottky diode, GUNN diode and PIN diodes, GaAs MESFET, HEMT, PHEMT, MMIC devices. **Microwave Measurements: M**easurement of SWR and VSWR, impedance matching, frequency wavelength and Vector Network Analyzer (VNA), Microwave bridges.

Suggested Readings:

- Microwave devices and circuits by Samuel Liao, PHI
- Microwave Circuits by R.E. Collins, McGraw Hill
- Microwave Circuits by K.C. Gupta and I.J. Bahl, Artech house
- Elements of Electromagnetics by Matthew N.O. Sadiku,, Oxford Univ. Press, 3rd Ed., 2001

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Microwave Frequency bands	https://www.youtube.com/watch?v=8Sdp1PYeboU
	TE & TM modes	https://www.youtube.com/watch?v=dYKGsJGPsDo
Unit-II	Directional couplers	https://www.youtube.com/watch?v=4poo1q3GvTg
	Reflex Klystron	https://www.youtube.com/watch?v=59xw9DsMniY
Unit-III	PHEMT	https://www.youtube.com/watch?v=h-4PuqmTbm8
Unit-IV	Gauss law	https://www.youtube.com/watch?v=qerz-Z-OQiI
	Poynting vector	https://www.youtube.com/watch?v=oW9GO5mVJkY

Course Code	**PCC-ECE-303A**				
Category	Professional Core Courses				
Course Title	**COMMUNICATION ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	4	
Course Objectives	The objectives of this course are to • To develop signal analysis using Fourier and sampling techniques. • To explore entropy, channel capacity, coding, and noise concepts. • To develop probability-based analysis of random signals and variables. . • To investigate random processes and coding techniques.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Examine the spectral analysis of signals using Fourier series and transforms.
CO2	Define and understand information theory concepts and methods used to enhance the efficiency of communication systems..
CO3	Implement random theory principles to model and predict system behavior in communication networks.
CO4	Classify filter techniques for detection and performance improvement processes in different communication networks.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Spectral Analysis:** Basics of spectral analysis and frequency domain representation of signals. Fourier Series and Fourier Transforms for analysis of periodic and non-periodic signals. Convolution Theorem and its applications in signal processing. Correlation, Cross-Correlation, and Autocorrelation of signals. Sampling Theorem, signal reconstruction, and aliasing effects.
Unit-II	**Information Theory:** Introduction to information and entropy, channel capacity for discrete and continuous channels, Shannon's Theorem, Shannon-Hartley Theorem, Noisy channels, coding theory : Shannon-Fano coding, minimum redundancy coding, maximization of entropy of a continuous message transmission rate, effect of medium on the information, selection of channels ,effect of noise and its minimization.

Unit-III	**Random Signal Theory:** Representation of random signals, concept of probability and probability of joint occurrence, conditional probability, discrete probability theory, continuous random variables, probability distribution function, probability density function and joint probability density functions.
Unit-IV	**Random Processes and Coding Techniques:** Statistical average and moments, Ergodic processes, correlation Function, power spectral density, central limit theory, response of linear system to random signals. Error function Covariance relation among the spectral densities of the two input-output random processes. Cross spectral densities, optimum filters. Introduction to Linear Block Code and cyclic Codes.

Suggested Readings:

- Principles of Communication Systems by Taub Schiling; TMH
- Communication Systemsby Singh and Sapre ; TMH
- Communication Systems by A Bruce Carlson; TMH
- Communication Engineering by Sanjay Sharma byS.K.Kataria& Sons
- Communication Systems by Simon Haykin bypearson

Useful Video Links:

Unit No	Topics	Links
Unit-I	Convolution Theorem	https://www.youtube.com/watch?v=AILlSc73eqs
	Fourier series	https://www.youtube.com/watch?v=CDeT2yV_CbM&list=PLU6SqdYcYsfJfRHH0K1CgNkheUKk2fBb6
	Fourier transforms	https://www.youtube.com/watch?v=GtXmS5YH7XM
Unit-II	Shannon's Theorem	https://www.youtube.com/watch?v=7nrIkh0B3Xo
	Shannon-Hartley Theorem	https://www.youtube.com/watch?v=lQHjREaGJVc
	Shannon-Fano coding	https://www.youtube.com/watch?v=g2UlDNamG84
Unit-III	conditional probability	https://www.youtube.com/watch?v=w4B_S_DFqfg
	concept of probability	https://www.youtube.com/watch?v=WyUfvnfa3aw
	distribution function	https://www.youtube.com/watch?v=qQvGv9NREBg
Unit-IV	Ergodic processes	https://www.youtube.com/watch?v=j8FhEZ8nXmA
	Power spectral density	https://www.youtube.com/watch?v=Cg0_k1Dy0b4
	Linear Block Code	https://www.youtube.com/watch?v=dTPzZ3X-wLA

Course Code	**PCC-ECE-305A**				
Category	Professional Core Courses				
Course Title	**CONTROL SYSTEM ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	4	
Course Objectives	The objectives of this course are • To introduce basic control systems. • To explain time domain response and stability. • To apply frequency domain analysis and design. • To explore state space methods and system properties.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define feedback and open-loop control architectures and explain the robustness and stability requirements in control design.
CO2	Determine transfer functions using block-diagram reduction and Mason's gain formula and compute transient and steady-state responses to standard inputs.
CO3	Analyze system stability using the Routh–Hurwitz criterion and interpret root-locus plots for closed-loop pole movement and controller design.
CO4	Model LTI systems in state-space form and analyze frequency response using Bode and Nyquist plots for stability and performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Basic of Control System :**Transfer function, Basic of a control system, Introduction: open-loop control system, close-loop control system, Block diagram, Signal flow graphs, Modeling a control system, Electrical network and Mechanical System, DC and AC servo Systems-Synchronous -Multivariable control system.
Unit-II	**Time Response Analysis and Stability Concept:** Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and PID controller. Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability,Root Locus and its Application in Control Design.

Unit-III	**Frequency Domain Analysis :**Bode Plot - Polar Plot- Nyquist Stability Criterion, Relative Stability – Gain and Phase Margins, Design of compensators using Bode Plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation.
Unit-IV	**Control System Analysis Using State Variable Methods:** Concept of state space representation, Block diagram for a state equation, Solution of state equation, Transfer matrix, Controllability, and Observability. Transfer function of discrete data system, State equations of linear discrete data system, Stability of discrete data system, Steady state error analysis of discrete data control system, Equivalence between transfer function and state variable representations.

Suggested Readings:

- Control Systems Principles and Design by Gopal M, Tata McGraw-Hill.
- Automatic Control Systems by B.C. Kuo, Prentice Hall, Sixth Edition
- Modern Control Engineering, by Katsuhiko Ogata Prentice Hall, Second Edition
- Modern Control Engineering by Nagrath & Gopal, New Age International.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Basic of a control system	https://www.youtube.com/watch?v=XMfH2P2Fc6Q&list=PLWPirh4EWFpGpH_Rb6Q4iQ6vGGRA6MORZ
	Signal flow graphs	https://www.youtube.com/watch?v=vr4Hc0SNghQ
Unit-II	PID controller	https://www.youtube.com/watch?v=R8ldRXmqhMo&t=196s
Unit-III	Bode Plot	https://www.youtube.com/watch?v=vcV7kSFLf7k&list=PLgwJf8NK-2e7ocyYBq-Tv3tb2lR154p2H
Unit-IV	State space representation	https://www.youtube.com/watch?v=PGW2laCpvJ0&list=PLgwJf8NK-2e6zb5ztH0FEnYHKj1HqQxQC
	Controllability and Observability	https://www.youtube.com/watch?v=X0kKIkycwiI

Course Code	**PCC-ECE-307A**				
Category	Professional Core Courses				
Course Title	**COMPUTER ORGANIZATION & ARCHITECTURE**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • To develop understanding of data representation and coding. • To gain knowledge of computer organization and CPU architecture. • To build insight into pipelining and parallel processing. • To acquire familiarity with I/O organization and memory hierarchy.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Apply data representation techniques, register transfer and micro-operations for efficient data processing.
CO2	Analyze instruction codes, registers, memory operations, and I/O mechanisms in optimizing CPU-I/O communication efficiency.
CO3	Apply architectural concepts and parallel processing principles in designing of CPU.
CO4	Describe the hierarchy, types, and operational mechanisms of memory organization for system optimization.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Data representation:** Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes **Register Transfer and Microoperations**: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit-II	**Basic Computer Organization and Design :**Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic. **Central Processing Unit :** General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.
Unit-III	**Pipeline and Vector Processing:** Introduction to Parallel Processors, Amdahl's Law, parallel bus architectures, Parallelism via Instructions -Instruction-Level Parallelism (ILP) Thread-Level Parallelism (TLP) ,Data-Level Parallelism (DLP) Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors, SIMD Array Processors, Pipeline Hazards.
Unit-IV	**Input-output Organization:** I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts. Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

Suggested Readings:

- Computer System Architectureby M.Morris Mano, Pearson
- Computer Organization and Design: The Hardware/Software Interface by David A. Patterson and John L. Hennessy, Elsevier.
- Computer Organization and Embedded Systemsby CarlHamacher, McGraw Hill Higher Education.
- Computer Architecture and Organization by latest edition by John P. Hayes, WCB/McGraw-Hill
- Computer Organization and Architecture: Designing for Performanceby William Stallings, Pearson Education
- Computer System Design and Architectureby Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Useful Video Links:

Unit No.	Topics	Links
Unit I	Data Types	https://www.youtube.com/watch?v=0OoNpd41ZiI
	Error Detection Codes	https://www.youtube.com/watch?v=U7-h2hyM1Dc
	Floating-Point Representation	https://www.youtube.com/watch?v=4gNs7B4ZTjc
	Register Transfer and Microoperations	https://www.youtube.com/watch?v=mNNywW00eEc
Unit II	Instruction Cycle	https://www.youtube.com/watch?v=_W4Yd-yiyog
	Design of Accumulator Logic	https://www.youtube.com/watch?v=Veas4VD5b54
	RISC, CISC	https://www.youtube.com/watch?v=ZW1gb3h-f9k
	Addressing Modes	https://www.youtube.com/watch?v=_CH4cm5PhK8
Unit III	Pipeline and Vector Processing	https://www.youtube.com/watch?v=QLmDUABw0dE
	Array Processors	https://www.youtube.com/watch?v=WIQqig_awGw
	Amdahl's Law	https://www.youtube.com/watch?v=2dYV_lADfFI
Unit IV	Privileged & Non-Privileged Instructions	https://www.youtube.com/watch?v=z0URQryCbI0
	Memory organization	https://www.youtube.com/watch?v=lKVu02WjhoI
	Memory Hierarchy	https://www.youtube.com/watch?v=zwovvWfkuSg

Course Code	**PCC-ECE-309A**				
Category	Professional Core Courses				
Course Title	**MEASUREMENT, INSTRUMENTATION & SENSORS**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are to • To understand measurement principles and instrumentation systems. • To study transducers and sensors used in measurement systems. • To learn signal conditioning and measurement analysis techniques. • To explore digital instruments and virtual instrumentation systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Apply fundamental principles and characteristics to analyze errors through proper calibration and standardized measurement methods.
CO2	Select and use appropriate analog and digital instruments to measure and display electrical parameters of electronic systems.
CO3	Interpret and apply suitable transducers and bridge circuits for accurate measurement of unknown electrical and non electrical parameters.
CO4	Analyze the signal and its harmonic components in time and frequency domain by using signal analyzers.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Science of Measurement** Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards Transducers Classification of Transducers – Variable Resistive transducers – Strain gauges , Thermistor, RTD-Variable Inductive transducers- LVDT, RVDT,- Variable Capacitive Transducers – Capacitor microphone- Photo electric transducers – Piezo electric transducers – Thermocouple – IC sensors - Fiber optic sensors – Smart/intelligent sensors.
Unit-II	**Signal Conditioning and Signal Analyzers** DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering. Pre- amplifier –Isolation amplifier – Filters – Data acquisition systems. Spectrum Analyzers – Wave analyzers – Logic analyzers

Unit-III	**Digital Instruments** Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution inDVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE488/GPIB Buses.
Unit-IV	**Data Display Recording and Systems** Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and DigitalRecorders and printers. Virtual Instrumentation - Block diagram and architecture –Applications in various fields. Measurement systems applied to Micro and Nanotechnology.

Suggested Readings:

- Modern Electronic Instrumentation and MeasurementTechniques by Albert D.Helfrick and William D. Cooper, Prentice Hall of India, latest edition
- A course in Electrical & Electronics Measurements & Instrumentation byA.K.Sawhney; Dhanpat Rai & Sons.
- Electronic Instrumentation and Measurements by JB Gupta, Katson Publication.
- Electrical and Electronic Measurements and Instrumentation by R.K Rajput, S.Chand Publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Measurement System	https://www.youtube.com/watch?v=pFM9K9JrsU4&list=PLm_MSClsnwm8QtyYpwmQpXjp1XnvuKcRk
	Transducers Classification of Transducers	https://www.youtube.com/watch?v=CzafQ5GWz4s
	LVDT	https://www.youtube.com/watch?v=zkixSsT2p7w
Unit-II	AC bridges introduction	https://www.youtube.com/watch?v=5gHei6Bx1JU&list=PLU0veo5_-xYDK6GGasYOLChoFbgJYnYsX
	Maxwell LC bridge	https://www.youtube.com/watch?v=wbhWgqoY8U0&list=PLU0veo5_-xYDK6GGasYOLChoFbgJYnYsX&index=9
	Spectrum Analyzers	https://www.youtube.com/watch?v=8Zhufd64rGg
Unit-III	Digital Voltmeters	**https://www.youtube.com/watch?v=rgacCQJulEE**
Unit-IV	DVM	https://www.youtube.com/watch?v=Q8SQzc7Yj-0
	Digital storage oscilloscope block diagram and working	https://www.youtube.com/watch?v=0DbpIoJyskk

Course Code	**PEC-ECE-311A**				
Category	Professional Elective Courses				
Course Title	**INTRODUCTION TO MEMS**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • To introduce fundamentals of MEMS, microsystems, scaling, and their applications. • To provide knowledge of MEMS fabrication and micromachining techniques. applications. • To develop understanding of mechanical behavior in MEMS structure. • To familiarize with modeling and analysis of MEMS devices.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define MEMS concepts, scaling principles and applications of micro/nano sensors and actuators.
CO2	Explain MEMS fabrication and micromachining techniques for development of microsystems.
CO3	Apply fundamental stress, strain, and energy principles to analyze the mechanical behavior of MEMS structures.
CO4	Analyze MEMS devices using finite element and coupled electromechanical approaches.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Overview of MEMS and Microsystems: Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries.
Unit-II	Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques,Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificiallayer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.
Unit-III	Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes law, Poisson effect, Linear, Thermal Expansion, Bending; Energy methods. Introduction to Scaling, Scaling in Geometry, Rigid Body dynamics, Electrostatic forces, Electromagnetic forces, Electricity, Fluid Mechanics, Heat Transfer.

Unit-IV	Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems: Electrostatics, Coupled electro mechanics.

Suggested Readings:

- Microsystem Design by Stephen D.Senturia, Kluwer academic publisher,2001.
- Micro-Electromechanical systems by S.E.Lyshevski .
- Fundamentals of Nano-and Microengineering by M. Madou, CRC press, 2005.
- Fundamentals of Microfabrication by M. Madou, CRC Press, 1997.
- Micromachined Transducers Sourcebook by G. Kovacs, McGraw-Hill, Boston, 1998.
- Micromechanical Transducers by M.H. Bao , New York, 2000.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to MEMS & MicrosystemsMEMS Introduction and Applications	https://www.youtube.com/watch?v=j9y0gfN9WMg onlinecourses.nptel.ac.in
Unit-II	MEMS Fabrication	https://onlinecourses.nptel.ac.in/noc19_ee40/preview
Unit-III	Mechanics of Solids	https://nptel.ac.in/courses/105104160
Unit-IV	A brief Introduction of Micro-Sensors	http://digimat.in/nptel/courses/video/108106165/108106165.html

Course Code	**PEC-ECE-313A**				
Category	Professional Elective Courses				
Course Title	**VHDL & Digital Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the fundamentals of CAD tools and hardware description languages. • To learn VHDL coding techniques to model combinational and sequential circuits. • To get the knowledge of design with programmable logic devices. • To learn the concept of Finite State Machines in VHDL.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the fundamental concepts of digital electronics and VHDL for digital system design.
CO2	Develop and implement VHDL models for combinational and sequential circuits.
CO3	Analyze the architecture, structure, behaviour and operational functionality of digital systems.
CO4	Implement design logics on programmable logic devices and finite state machines to develop, validate and optimize digital circuits.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction**: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Generics, Packages and Libraries, Entity and Architecture declaration.
Unit-II	**VHDL Statements:** Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Functions and Procedures, Structural Modelling, component declaration, structural layout.

Unit-III	**Combinational & Sequential Circuit Design**: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc.VHDL Models and Simulation of Sequential Circuits such as Shift Registers, Counter, ALU,RAM, ROM.
Unit-IV	**VHDL Programmable logic devices**: PLAs, PALs, GAL,PEEL, CPLDs and FPGA. Design of FSM: Moore FSM , Mealy FSM, Moore Mealy variants, Finite State Machine, Modeling of FSM using VHDL.

Suggested Readings:

- VHDL Primer by J Bhasker, Pearson Education/PHI 3rd Edition.
- Digital System Design using VHDLby Charles. H.Roth ; PWS latest edition
- Modern Digital Electronics by III Edition: R.P Jain; TMH latest edition
- VHDL-Analysis & Modelling of Digital Systems by Navabi Z; McGraw Hill
- Fundamentals of Digital Logic with VHDL Design by Brown and Vranesic, TMH latest edition
- VHDLby Perry; TMH latest edition
- Digital System Design with VHDL by Mark Zwolinski, latest edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to VHDL	https://www.youtube.com/watch?v=mwJ3uMWvJX0
	Basic Components in VHDL	https://www.youtube.com/watch?v=k6eHc6kUJkk
	Operators, Types of Delays	https://www.youtube.com/watch?v=kXnHbLFEBHw https://www.youtube.com/watch?v=SKiGzphYJ1Q
Unit-II	Basic Structure of VHDL code	https://www.youtube.com/watch?v=PEViqQ_1i1c
	Sequential Statements and Loops	https://www.youtube.com/watch?v=Kta7Svp9dBg
	Sequential and Concurrent Statements	https://www.youtube.com/watch?v=6PWiFdwJTzw
	Functions and Procedures in VHDL	Functions and Procedures in VHDL
Unit-III	Multiplexer, Decoders, PLA	https://www.youtube.com/watch?v=3LHNvx9PMQg
	Code Converters	https://www.youtube.com/watch?v=kgL5UaSVuro
	VHDL Modeling of up/down Counter	https://www.youtube.com/watch?v=P-nOuzQEg4Q
	Shift register in VHDL	Shift Registers in VHDL 4 Bit Shift Registers Tutorial with VHDL
Unit-IV	Digital System Design with PLDs and FPGAs	http://www.digimat.in/limesurvey/index.php/117108040
	Design of Finite State Machines	https://www.youtube.com/watch?v=YgtJlUXdCjI https://www.youtube.com/watch?v=XCLmatskK5w

Course Code	**PEC-ECE-315A**				
Category	Professional Elective Courses				
Course Title	**SPEECH & AUDIO PROCESSING**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand speech production and coding techniques. • To analyze speech signals using prediction and quantization. • To study LPC-based speech coding methods. • To learn CELP techniques and speech coding standards.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify key concepts of speech production, auditory perception and classification of speech coding techniques.
CO2	Understand speech processing methods including spectral analysis, autocorrelation and linear prediction models.
CO3	Implement speech quantization and coding techniques such as LPC-based methods for speech compression.
CO4	Analyze and compare advanced speech coding techniques like CELP and evaluate speech coding standards based on quality, delay, and robustness.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction**- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.
Unit-II	**Speech Signal Processing-**pitch estimation, speech filters, convolution, spectral analysis, autoregressive modeling, and autocorrelation estimation. Linear Prediction of Speech - linear prediction concepts, prediction analysis, Levinson–Durbin algorithm, and long-/short-term prediction models. Speech Quantization- scalar and vector quantization, adaptive and differential quantizers, distortion measures, and codebook design.

Unit-III	**Scalar Quantization of LPC**- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. **Linear Prediction Coding-** LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.
Unit-IV	**Code Excited Linear Prediction-**CELP speech production model; Analysis-by-synthesistechnique. Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

Suggested Readings:

- Digital Speechby A.M.Kondoz
- Speech Coding Algorithms: Foundation and Evolution of Standardized Coders by W.C.Chu, WileyInter science
- Fundamentals of Speech Recognition, by Lawrence Rabiner, Bing-Hwang Juang and B. Yegnanarayana, Pearson Publications,1st Edition
- Speech and Audio Signal Processing by Ben Gold and Nelson Morgan
- Audio Signal Processing and Coding by Andreas Spanias, Ted Painter, and Venkatraman Atti

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Speech Coding: Objectives and Requirements Audio Coding: Basic Concepts	https://www.youtube.com/watch?v=MBxFVBAzdMc https://www.youtube.com/watch?v=aCvceLLrE0k
Unit-II	Linear Prediction of Signals Basics of Scalar Quantization Vector Quantization	https://www.youtube.com/watch?v=1k7FPs-6X88 https://www.youtube.com/watch?v=CmEV6HdexKc https://www.youtube.com/watch?v=CKNjEp_38GI
Unit-III	Scalar Quantization -The Quantization Problem Linear Prediction, Formants LPC for speech synthesis	https://www.youtube.com/watch?v=hL1untZ1wwE https://www.youtube.com/watch?v=NtTYdYffalY https://www.youtube.com/watch?v=Sayks3lFLXM
Unit-IV	Speech Coding III Code excited LPC and Residual Excited LPC	https://www.youtube.com/watch?v=y0iIZ8LZ1jc https://www.youtube.com/watch?v=7qbxqFlUAlI

Course Code	**PEC-ECE-317A**				
Category	Professional Elective Courses				
Course Title	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the fundamentals of artificial intelligence. • To study AI search and problem-solving techniques. • To learn knowledge representation and logical reasoning methods. • To explore planning and probabilistic reasoning in AI systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
CO2	Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
CO3	Analyze Supervised Learning Vs. Learning Decision Trees.
CO4	Design and Implement the applications of Probabilistic Reasoning and Bayesian Networks.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to AI - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.
Unit-II	Games - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, LogicPropositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.
Unit-III	First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

Unit-IV	Planning - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning. Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions.

Suggested Readings:

- Introduction to Artificial Intelligence by Rajendra Akerkar, PHI Publications.
- Artificial Intelligence: A modern approach by Stuart Russell & Peter Norvig, Pearson Publications Fourth Edition.
- Modern Microeconomics: Theory and Applications by H.L. Ahuja, S. Chand & Company Pvt. Ltd.
- Introduction to Artificial Intelligence and Machine Learning by Dr. Swapna, Dr, Bharat Kumar GJ, Dr. Bhoomeshwar Bala, Walnut publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Artificial Intelligence	https://www.youtube.com/watch?v=uB3i-qV6VdM&list=PLxCzCOWd7aiHGhOHV-nwb0HR5US5GFKFI
Unit-II	Constraint Satisfaction Problem (CSP) in AI with Example Constraint Satisfaction Algorithm Works	https://www.youtube.com/watch?v=AgyCSmDVk5s https://www.youtube.com/watch?v=udOfKqeLVSg
Unit-III	First order/Predicate logic | Artificial Intelligence Negation of Quantifiers | Predicate Logic	https://www.youtube.com/watch?v=Aw3EOSr64j0 https://www.youtube.com/watch?v=XYfTz5gziBk
Unit-IV	Planning Introduction - Artificial Intelligence Planning Graph in Artificial Intelligence	https://www.youtube.com/watch?v=TK7ORfbT5UI&list=PLAHr0cis_HGUOO9lSd4dTJ-37qCFtlBgh https://www.youtube.com/watch?v=JGrU9Bcf4wA&list=PLAHr0cis_HGUOO9lSd4dTJ-37qCFtlBgh&index=7

Course Code	**PEC-ECE-319A**				
Category	Professional Elective Courses				
Course Title	**WIRELESS SENSOR NETWORKS**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To introduce WSN fundamentals, challenges, and applications. ● To explain MACprotocols and standards (IEEE 802.15.4, ZigBee). ● To develop skills in data dissemination and Internet integration. ● To analyze node architecture, hardware design and Tiny OS.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Define basics constraints, challenges, and applications of WSNs; differentiate from MANETs.
CO2	Explain routing/MAC protocols (S-MAC, B-MAC) and standards (IEEE 802.15.4, ZigBee).
CO3	Apply data dissemination, gathering, fusion, QoS, security, and gateway concepts for WSN–Internet integration.
CO4	Analyze node architecture, hardware constraints, power/security issues, and collaborative processing using Tiny OS.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	Fundamentals: Introduction to Sensor Network unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks, Mobile Ad hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks.
Unit-II	Protocol Layer: Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B MAC protocol, IEEE 802.15.4 standard and ZigBee
Unit-III	Data & Gateway Concepts: Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.
Unit-IV	Node & System Architecture: data collection and processing, collaborative information processing and group connectivity Target tracking, localization and identity management. Power management, Security and privacy, Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to Tiny OS and nesC.

Suggested Readings:

- Fundamentals of Wireless Sensor Networks Theory and Practice by John Wiley & Sons Publications,2011
- Sensors Handbook by Sabrie Soloman, McGraw Hill 2009
- Wireless Sensor Networks by Feng Zhao, Leonidas Guibas, Elsevier Publications 2004
- Wireless Sensor Networks Technology by Kazem Sohrabi, Wiley-Interscience

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Sensor Network	https://www.youtube.com/watch?v=PrnNKZJj-Oc
Unit-II	MAC protocols	https://www.youtube.com/watch?v=YAjfUc7Tt24&list=PLTmU03EUNiEeHQq1chuiRBb94OspHJtsV_g
Unit-III	Design Principles for WSNs	https://www.youtube.com/watch?v=P16atBN6knc
Unit-IV	Node & System Architecture	https://www.youtube.com/watch?v=VavRifvVwIo

Course Code	**LC-ECE-321A**				
Category	Professional Core Courses				
Course Title	**MEASUREMENT, INSTRUMENTATION & SENSORS LAB**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are • To provide hands-on exposure to electronic components, instruments, and measurement techniques. • To demonstrate working principles and troubleshooting methods of common electronic instruments. • To train students in the use of test equipment and transducers for measuring physical parameters. • To develop skills for analyzing faults and evaluating the performance of electronic systems.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the principles and functioning of electronic components, instruments, and basic measurement systems used in electronic applications.
CO2	Apply electronic instruments and tools to perform measurements and testing of electronic circuits and systems effectively.
CO3	Analyze experimental data to determine performance characteristics of electronic systems and measurement devices.
CO4	Evaluate faults in electronic systems and select appropriate troubleshooting techniques based on observations and measured data.

List of Experiments

Sr.No.	Contents
1	To study and demonstrate the working functions and various faults of the cathode ray oscilloscope.
2	To study and demonstrate the working functions and various faults of the function generator.
3	To study and demonstrate the working functions and various faults of the multimeter.
4	To understand the operating principles of a logic pulser.
5	To study and demonstrate the working functions and various faults of LED TV Trainer.

6	To study the working of strain gauge trainer and measure its parameters.
7	To study the characteristics of LVDT for measuring linear displacement.
8	To study the characteristics of temperature transducers like thermometer, thermocouple etc.
9	To measure the Quality factor of L, R, and C using LCRQ meter.
10	To measure the water level using a capacitive transducer.
11	To measure the differential pressure using a pressure transducer.
12	To study distortion factor meter and determination of the percentage distortion of the given oscillator.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topics beyond the syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Function Generator debug and repair	https://www.youtube.com/watch?v=x3z2QSVtjSA
2	Understanding of LCR Meters	https://www.youtube.com/watch?v=vi9t5gdog7Q
3	Capacitive Water Level Measurement	https://www.youtube.com/watch?v=0du-QU1Q0T4
4	Pressure Transducer	https://www.youtube.com/watch?v=DVq10SGKHMU
5	Strain Gauge Trainer	https://www.youtube.com/watch?v=nFUo_txmw5M
6	Logic Pulser Working	https://www.youtube.com/watch?v=LIVUUyPI--4
7	LVDT Experiment	https://www.youtube.com/watch?v=00lk2jG_s_E
8	Temperature Transducers (Thermocouple / RTD)	https://www.youtube.com/watch?v=MPu-0xHPOGc

Course Code	**LC-ECE-323A**				
Category	Professional Core Courses				
Course Title	**ELECTROMAGNETIC & MICROWAVE ENGINEERING LAB**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	0	0	2	1	
Course Objectives	The objectives of this course are to ● To study microwave components, waveguides and radiation patterns. ● To measure impedance, frequency, wavelength, and VSWR. ● To study characteristics and tuning of Reflex Klystron and Gunn diode sources. ● To study coupling, insertion loss, directivity, and isolation in microwave devices				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Demonstrate microwave test bench to measure and analyze waveguide parameters and applications.
CO2	Use microwave test bench setup with frequency meter to determine modes and operations.
CO3	Implement techniques of antenna for obtaining radiation pattern and its parameters.
CO4	Analyze waveguide concepts and model wave propagation in rectangular waveguides to understand their behavior and applications.

List of Experiments

Sr. No.	Contents
1	To study various waveguide components and their functions in microwave system.
2	To study an antenna and analyze its radiation pattern for determining beam width.
3	To measure the impedance of an unknown load using microwave measurement techniques.
4	To study isolation and coupling coefficient of a magic Tee.
5	To determine frequency and wavelength in a rectangular waveguide on TE10 mode.
6	To measure the attenuation of an attenuator.
7	To measure the SWR in a microwave transmission line.
8	To study the characteristics of Reflex Klystron tube to determine its electronic tuning range.
9	To study measurement of relationship among guide dimensions, free space wavelength and guide wavelength
10	To study the characteristics of Gunn oscillator & Gunn diode as a modulated source.
11	To measure coupling coefficient, Insertion loss & Directivity of a Directional coupler.
12	To study the characteristics of radar and determine its radiation range .

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	To determine frequency and wavelength in a rectangular waveguide on TE10 mode	https://www.youtube.com/watch?v=oh_5D5Jw98E
2	Measurement of SWR in a Microwave transmission line.	https://www.youtube.com/watch?v=tm3oU0SAHA4
3	To measure the impedance of unknown load.	https://www.youtube.com/watch?v=kxPhsyjleA0

Course Code	**PT-ECE-325A**				
Category	Training				
Course Title	**PRACTICAL TRAINING-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are to ● To introduce circuit simulation using industry-standard software tools for electronic analysis. ● To study technical documentation, engineering processes and industry standards in real-world projects. ● To demonstrate professional communication, time management and ethical practices in industrial settings. ● To analyze engineering problems and develop solutions using industry-standard tools and methodologies.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Interpret industry standards, technical documentation and engineering processes used in real-world projects.
CO2	Interpret industry standards, technical documentation and engineering processes used in real-world projects.
CO3	Demonstrate effective communication, time management skills and professional ethics in an industrial setting.
CO4	Analyze practical engineering problems and develop solutions through teamwork and professional collaboration.
CO5	Evaluate the mechanism for integrating theoretical concepts into innovative practical scenarios to enhance problem-solving skills in industrial applications.
CO6	Integrate engineering tasks using industry-standard tools, software and methodologies under professional supervision.

Guidelines:

- The Practical Training shall be carried out individually or under a faculty/industry mentor, focusing on real-world electronics and communication engineering tasks.
- The training may involve hands-on circuit simulation, hardware testing, or use of industry-standard software tools, with documentation forming an essential part of the work.
- After consultation with the training supervisor, students shall finalize the training title, aim, and objectives based on the assigned industrial problem or domain.

- Students are required to prepare a training plan in the early phase of the semester, including scope of work, tools and software to be used, methodology, and expected outcomes.
- The training work shall involve observation, analysis, and implementation of engineering tasks as per the scheduled timeline under professional supervision.
- Circuit simulation, analysis, and testing should be carried out using industry-standard EDA or simulation software tools such as Multisim, LTspice, or Proteus.
- Students must maintain a training logbook recording daily/weekly activities, observations, and outcomes throughout the semester.
- The completed training, along with documentation in the form of a training report, must be submitted at the end of the semester.
- Students shall strictly follow the professional ethics, discipline, and code of conduct applicable in the industrial or laboratory environment during the training period.
- Effective communication skills, punctuality, and time management must be demonstrated by students throughout the duration of the practical training.
- Students are expected to study and interpret relevant technical documentation, datasheets, and industry standards related to their assigned training domain.
- Teamwork and collaborative problem-solving skills shall be encouraged wherever group-based training activities or industry interactions are involved.
- Available sessions may be utilized for discussions on industry standards, technical documentation practices, professional communication skills, and report writing guidelines.
- At the end of the training, students shall deliver a presentation summarizing their training experience, tasks performed, outcomes achieved, and lessons learned.
- The training report must include an introduction, objectives, tools and technologies used, work performed, results, conclusions, and references following a standard technical documentation format.

Course Code	**LC-ECE-327A**				
Category	Project				
Course Title	**Mini Project - 1**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are to ● The objectives of this course are to ● To expose students to domains related to real-world engineering problems. ● To introduce structured approaches for project planning, execution, documentation and technical presentation. ● To enable the use of engineering concepts, tools and technologies for developing practical project solutions. ● To create awareness of ethical, economic, environmental, and sustainability considerations in engineering projects.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify and summarize the problem statement, hardware & software tools and relevant domain for project work planning.
CO2	Develop skills to write technical reports and deliver effective presentations.
CO3	Apply engineering principles and ethics to address real-world problems and foster lifelong learning.
CO4	Implement skills to manage the problem encountered by individuals and as a team for better resource utilization.
CO5	Analyze and assess methods and parameters for optimized resource utilization to ensure an efficient technical solution.
CO6	Design and develop innovative, sustainable, cost-effective and environment friendly solutions to real world problems for societal benefits.

Guidelines:

1. The Mini/Micro Project shall be carried out as a team activity comprising 2 to 4 students, focusing on real-life problems using electronic devices and systems.
2. The project may involve complete hardware or a combination of hardware and software, with the software component limited to less than 50% of the total work.
3. After consultation with the project guide and based on literature survey and need analysis, students shall finalize the project title, aim, and objectives.
4. Students are required to prepare a project proposal in the early phase of the semester, including specifications,

methodology, required resources, and critical design/implementation issues.

5. The project work shall involve design, development, and testing as per the planned schedule.
6. Circuit design, artwork, and layout should be carried out using CAD-based PCB design and simulation software.
7. The completed project, along with documentation in the form of a project report, must be submitted at the end of the semester.
8. Available sessions may be utilized for discussions on standard design practices, PCB design techniques, product development approach, and report writing guidelines.

Useful Video Links:

Details of Links
• https://www.youtube.com/@EEVblog • https://www.youtube.com/@greatscottlab • https://www.youtube.com/@allaboutelectronics • https://www.youtube.com/@mcwhorpj • https://www.youtube.com/@Dronebotworkshop • https://www.youtube.com/@AndreasSpiess • https://www.youtube.com/@StuffMadeHere • https://www.youtube.com/@hacksmith • https://www.youtube.com/@allenpan • https://www.youtube.com/@ElectroBOOM • https://www.youtube.com/@adafruit • https://www.youtube.com/@sciguy14 • https://www.youtube.com/watch?v=jtpqsVKtu9Y • https://aislyn.in/project-ideas/electronics-communication-engineering-ideas • https://www.electronicsforu.com/electronics-projects/hardware-diy/ece-projects • https://www.youtube.com/watch?v=5ArmM80YMSM

Course Code	**PCC-ECE-302A**				
Category	Professional Core Courses				
Course Title	**DIGITAL SIGNAL PROCESSING**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	3	1	0	4	
Course Objectives	The objectives of this course are • To understand the fundamental concepts and design techniques of digital signal processing. • To get the knowledge of various methods to design FIR and IIR digital filters. • To learn the multirate signal processing techniques in digital signal processing.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the properties of signals & systems to design and develop digital systems.
CO2	Apply various transforms to process signals in real-time applications.
CO3	Implement various techniques used for designing the digital filters.
CO4	Analyze multirate digital signal processing (MDSP) techniques to solve signal processing problems and improve data efficiency in communication systems.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Discrete-Time Signals and System:** DSP: Advantages, Disadvantages, Applications,Classification of signals, representation of discrete systems, Sampling and reconstruction of signals, aliasing, Sampling theorem and Nyquist rate. **Z-Transform**: Z-Transform, Region of Convergence(ROC), Properties of z-transform, Inverse z-transforms: Long division method, Partial fraction expansion method, Residue method.
Unit-II	**Frequency Representation of Signal and Systems:** Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms for Radix-2 & composite numbers.

Unit-III	**Design of Digital Filter** :General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling Method, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.
Unit-IV	**Implementation of Discrete Time Systems:** Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects. **Multirate Digital Signal Processing:** Introduction to multirate digital signal processing, Multirate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

Suggested Readings:

- Digital Signal Processing: Principles,Algorithms And Applications by John G. Proakis and D.G. Manolakis, Prentice Hall, latest edition
- Discrete Time Signal Processing by A.V. Oppenheim and Schafer, Prentice Hall,latest edition
- Digital Signal Processing by Salivahanan, Vallavaraj and Gnanapriya;TMH
- Theory and Application of Digital Signal Processing by L.R. Rabiner and B. Gold, Prentice Hall, latest edition
- Introduction to Digital Signal Processing by J.R. Johnson, Prentice Hall, latest edition
- Digital Signal Processing by D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, John Wiley& Sons, latest edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	DSP Introduction	https://www.youtube.com/watch?v=6dFnpz_AEyA
	Sampling and reconstruction of signals	Week 1 || Solved Examples: Sampling and Reconstruction || NPTEL || DSP & Applications
	Z-Transform	https://www.youtube.com/watch?v=0XIYet-VRtA
	Inverse Z-Transform	https://www.youtube.com/watch?v=eqde-Erhk3s
Unit-II	DFT	https://www.youtube.com/watch?v=5HOaW3XA2nQ
	DITFFT	8-Point DFT Solved using Radix-2 DIT FFT Algorithm | Digital Signal Processing Problem Tutorial
Unit-III	Design of FIR Filters using Window technique	FIR Filter Design: Different Window Functions Explained (Rectangular, Hamming, Hanning, Blackman)
	Design of IIR Filters using Impulse Invariance technique	What is Impulse Invariance Method in Digital IIR Filter | Discrete Time Signal Processing
Unit-IV	Direct form, Cascade form and Lattice structures for FIR systems	Digital Filters: Cascade Form Structure & Realization | EC Academy Direct Form I and II Structures of Digital Filters in DSP | Transfer Function Representation LATTICE Form Representation of Digital Filters | Third-Order and Second-Order Examples | EC Academy
	MDSP	What is meant by Multirate Signal Processing or Multirate Sampling | Discrete Time Signal Processing
	Polyphase decomposition	How to design Polyphase Filter | Multi Rate Signal Processing | Discrete Time Signal Processing

Course Code	**PCC-ECE-304A**				
Category	Professional Core Courses				
Course Title	**ANTENNA & WAVE PROPAGATION**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	4	
Course Objectives	The objectives of this course are • To learn antenna fundamentals and radiation characteristics. • To gain knowledge of various antennas. • To implement antenna arrays and smart antenna concepts.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define and explain key fundamental concepts, characteristics, types and properties of antennas.
CO2	Design and analyze antenna systems by selecting appropriate parameters to meet specified frequency ranges and application requirements.
CO3	Illustrate wave propagation mechanism and their impact on antenna performance.
CO4	Apply synthesis techniques and analyze antenna arrays for desired radiation patterns.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fundamental Concepts-** Physical concept of radiation, Radiation pattern, near and far-field regions, reciprocity, directivity, gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions. Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.
Unit-II	**Aperture and Reflector Antenna**s, Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.
Unit-III	**Broadband Antennas-** Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

Unit-IV	**Antenna Arrays**- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method. Concept and benefits of smart antennas.

Suggested Readings:

- Antennas by J.D. Kraus, McGraw Hill, 1988.
- Antenna Theory - Analysis and Design by C.A. Balanis, John Wiley, 1982.
- Antennas and Radio Wave Propagation by R.E. Collin, McGraw Hill, 1985.
- Antenna Engineering Handbook by R.C. Johnson and H. Jasik, McGraw Hill, 1984.
- Micro Strip Antennas by I.J. Bahl and P. Bhartia, Artech House, 1980.
- Electromagnetic Waves by R.K. Shevgaonkar, Tata McGraw Hill, 2005

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Friis transmission equation	https://www.youtube.com/watch?v=Op7bBz6qbwY
Unit-II	Huygens' principle	https://www.youtube.com/watch?v=22YHJDoC7Uw
	Parabolic reflector and Cassegrain antennas.	https://www.youtube.com/watch?v=Ia6OnrqBeP8
Unit-III	Design of rectangular and circular patch antennas.	https://www.youtube.com/watch?v=MihOachw-MM
	Broadcast antenna	https://www.youtube.com/watch?v=cJkkicgfVQ8
Unit-IV	synthesis of antenna arrays using Schelkunoff polynomial method	https://www.youtube.com/watch?v=L9OyJJ_NxMY
	Woodward-Lawson method.	https://www.youtube.com/watch?v=UfCRaw-pmcc

Course Code	**PCC-ECE-306A**				
Category	Professional Core Courses				
Course Title	**CMOS DESIGN**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	3	0	0	3	
Course Objectives	The objectives of this course are to • To provide the CMOS circuit's behavior and its characteristics. • To explain combinational & sequential digital circuits. • To cover different Architectures and performance tradeoffs involved in designing and realizing the circuits in CMOS technology..				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Define and explain MOS transistor characteristics, CMOS logic and layout design principles for VLSI circuit implementation.
CO2	Illustrate combinational circuit design techniques considering power consumption, delay and interconnect effects in digital systems.
CO3	Implement sequential circuits with appropriate timing, synchronization and pipelining techniques for reliable system performance.
CO4	Design and optimize CMOS arithmetic units and memory architectures by analyzing and balancing trade-offs in speed, power and area using appropriate techniques to meet performance requirements.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction of MOS Transistor** MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling..

Unit-II	**Combinational Circuit Design** Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DPL Power: Dynamic Power, Static Power, Low Power Architecture. Interconnect: Interconnect Modelling and Impact
Unit-III	**Sequential Circuit Design** Static latches and Registers Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.Timing Issues: Timing Classification of Digital System, Synchronous Design
Unit-IV	**Design of Arithmetic Building Blocks and Subsystem** Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff. Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry

Suggested Readings:

- N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India, latest edition
- J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, latest edition
- C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, latest edition
- P. Douglas, VHDL: programming by example, McGraw Hill, latest edition
- L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, latest edition

Useful Video Links:

Unit No	Topics	Links
Unit-I	CMOS logic	https://www.youtube.com/watch?v=Ado4CD7jd68
Unit-II	Cascode Voltage Switch Logic	https://www.youtube.com/watch?v=eXi6P-A6LQ4
Unit-III	Registers Dynamic latches and Registers	https://www.youtube.com/watch?v=SV1qufFXTQU
Unit-IV	Designing Memory and Array	https://www.youtube.com/watch?v=EsGxt-XFLYY

Course Code	**PCC-ECE- 308A**				
Category	Professional Core Courses				
Course Title	**ADVANCE MOBILE COMMUNICATION TECHNOLOGIES**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the fundamentals of cellular and wireless communication systems. • To study wireless propagation models and fading characteristics in mobile channels. • To learn multiple access and digital modulation techniques used in wireless networks. • To explore mobility management and modern cellular technologies including GSM, UMTS, and LTE.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain cellular concepts, communication standards and mobility parameters to enhance efficiency of mobile networks.
CO2	Illustrate large-scale and small-scale fading effects in wireless networks using empirical propagation models.
CO3	Apply modulation techniques and multiple access schemes to efficiently utilize resources and reliable communication in wireless networks.
CO4	Analyze the impact of mobility, handoff mechanisms, power control and protocols in UMTS, LTE and advanced mobile systems to optimize network performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Cellular concepts-** Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Unit-II	**Large scale signal propagation.** Fading channels-Multipath and small scale fading- Doppler shift, doppler spread, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate. Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model.
Unit-III	**Multiple access schemes-**FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM and OFDMA.
Unit-IV	**Mobility in Cellular Systems:** The Gateway Concept, Measurement Reports, Mobility Procedures - Mobile IP: Basic Components, Tunneling GSM: Architecture, – UMTS: Architecture, Basics of CDMA, - Introduction to LTE: History, Architecture - OFDM – Uplink and Downlink Communication in LTE

Suggested Readings:

- Mobile Cellular Telecommunications Systems by WCY Lee, McGraw Hill, 1990.
- Mobile Communications Design Fundamentals by WCY Lee, Prentice Hall, 1993.
- Mobile Radio Communications by Raymond Steele, IEEE Press, New York, 1992.
- CDMA: Principles of Spread Spectrum Communications by AJ Viterbi, Addison Wesley, 1995.
- Wireless & Personal Communication Systems by VK Garg & JE Wilkes, Prentice Hall, 1996.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Handoff	https://www.youtube.com/watch?v=mNZSQ5dfXOA
	Overview of 2G and 3G cellular standards.	https://www.youtube.com/results?search_query=Overview+of+2G+and+3G+cellular+standards.+
Unit-II	Okumura Model	https://www.youtube.com/watch?v=uzLI85SazM4
	Log-distance path loss model.	https://www.youtube.com/watch?v=lcldzIXz3u8
Unit-III	multicarrier modulation	https://www.youtube.com/watch?v=L80aRAUcKyw
	OFDM and OFDMA.	https://www.youtube.com/watch?v=t7ks2llwILY
Unit-IV	Introduction to LTE	https://www.youtube.com/watch?v=DcmnJN3Qgx8&list=PLIjcuHcIw1q56zRPztlDxImMVsbhzwR8Z
	Basics of CDMA	https://www.youtube.com/watch?v=TV8etzFxjQU

Course Code	**PEC-ECE- 310A**				
Category	Professional Elective Courses				
Course Title	**FIBER OPTIC COMMUNICATION**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide the fundamentals of optical fiber communication and its applications. • To introduce optical fibers, light propagation, and fiber characteristics. • To provide knowledge of optical sources, detectors, and communication system components. • To explain optical fiber links, networks, and recent communication technologies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Describe the fundamental concepts, characteristics, losses, fabrication methods and applications of optical fiber communication.
CO2	Analyze the structure, efficiency and noise effects of optical sources and detectors in fiber optics.
CO3	Analyze link budget parameters and system effects to enhance the performance of optical communication systems.
CO4	Understand and apply optical amplifiers, modulation & multiplexing techniques and soliton based system for efficient data transmission in optical communication

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction:** Elements of Optical communication system. Principle of working, Ray Theory and electromagnetic mode theory for optical propagation. Type of optical fibers, step index and graded index and their characteristics. Optical losses: Attenuation, Absorption, Scattering, dispersion, polarization, and fiber bend losses. Fabrication techniques of fiber.

Unit-II	**Optical Sources:** Basic concepts of light source: LED and Lasers. Working principle, Shape geometry, efficiency, Fabry Perot laser, quantum well lasers, and MQM and Quantum dot lasers. Characteristics of both LED and Lasers. Optical Detectors: Working principle, PN, PIN diodes, APD. Efficiency and effect of noise.
Unit-III	**Link Budget:** Link design, path loss calculations, safety margin and budgeting. Optical termination and distribution system. Optical Amplifiers and Modulation: EDFA, SOA and Raman amplifiers. Intensity modulation, concept of WDM and DWDM systems and networks.
Unit-IV	**System Effects:** Nonlinear effects in fiber optic links. Concept of self-phase modulation, four wave mixing, Kerr effect. Soliton based communication system

Suggested Readings:

- Optical Fiber Communications: John M Senior; Pearson.
- Optical Communication Systems: John Gowar; PHI.
- Optical Fiber Communications: Gerd Keiser; TMH
- Optical Fiber Communication System: Dr. M.K. Raina, Satya Prakashan

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Optical Communication System	https://www.youtube.com/watch?v=pavBq7HIoIE
	Optical Fiber: Structure, Step Index & Graded Index Fiber	https://www.youtube.com/watch?v=8GTPFccxTA8
Unit-II	Optical Sources (LED & LASER)	https://www.youtube.com/watch?v=5cPDRNsMfnY
	Optical Detectors (PIN & APD)	https://www.youtube.com/watch?v=7gP4SNKvOtE&list=PLgwJf8NK-2e5paHjQ3IZl-Gh3OuaaUmqz
Unit-III	Optical Link Budget	https://www.youtube.com/watch?v=NctDb6pWpoA&list=PLgwJf8NK-2e6CGL-xtwXgcLwNA8TSxWZb
	Optical Amplifiers (EDFA, SOA, Raman) & WDM/DWDM	https://www.youtube.com/watch?v=WGItoWzHGos&list=PLgwJf8NK-2e70FZO1BgFttIqZLuyKX4EP
Unit-IV	Nonlinear Effects in Optical Fiber	https://www.youtube.com/watch?v=EiIDScj124Q&list=PLbRMhDVUMngfBwyonVP8VIsabtnsV3GVv
	Soliton Communication System	https://www.youtube.com/watch?v=C2niGcIjbxE

Course Code	**PEC-ECE-312A**				
Category	Professional Elective Courses				
Course Title	**HIGH SPEED ELECTRONICS**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To introduce basics of transmission lines, signal integrity and noise. ● To explain device models, oscillators, PLLs, and transceivers. ● To apply methods for PCB layouts and fabrication to reduce crosstalk and emissions. ● To analyze stability and efficiency of high frequency circuits.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define basics of transmission lines, signal integrity, and noise sources.
CO2	Explain device models, RF amplifiers, mixers, oscillators, PLLs, and transceiver architectures.
CO3	Apply methods for high-speed buses, PCB layouts, CAD tools, and fabrication to minimize crosstalk and emissions.
CO4	Analyze amplifier stability, noise figure, distortion, efficiency, and overall high frequency system performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise.
Unit-II	Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Intermodulation, Cross-modulation, Dynamic range. Devices:Passive and active, Lumped passive devices (models), Activemodels, low vs High frequency)
Unit-III	RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages. Mixers –Up conversion Down conversion, Conversion gain and spurious response. Oscillators Principles. PLL Transceiver architectures.
Unit-IV	Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

Suggested Readings:

- High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices by Stephen H. Hall ,Wiley-IEEE Press ,1st Edition, 2000
- The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee , Cambridge University Press ,2nd Edition, 2004
- RF Microelectronics by Behzad Razavi ,Prentice Hall ,1st Edition, 1998
- Electronic Product Design by R.G. Kaduskar, Wiley India ,1st Edition, 2011

Useful Video Links:

Unit No	Topics	Links
Unit-I	Transmission line theory	https://www.youtube.com/watch?v=HtoAbUqg_hM&list=PLdFco-rRUDt1pMTtPkI2lYq1X1NNjbKwg
	Radiated emissions	https://www.youtube.com/watch?v=bhHJrdtfT6E
Unit-II	Noise Figure	https://www.youtube.com/watch?v=ksoxRtfyx5Q
	Devices: Passive and active.	https://www.youtube.com/watch?v=X-qd5afdCMo
Unit-III	RF Amplifier Design	https://www.youtube.com/watch?v=KWl2lQkUCzE&list=PL9OnCetH8TYpFk-gC0SRB9izEIblJmjBm
	PLL Transceiver architectures	https://www.youtube.com/watch?v=yx5g99CNtmo
Unit-IV	CAD tools for PCB design	https://www.youtube.com/watch?v=NhC4MYKmCek&list=PLp6ek2hDcoNAUpqc3DUj4U5hcipc2idZ5

Course Code	**PEC-ECE-314A**				
Category	Professional Elective Courses				
Course Title	**ADAPTIVE SIGNAL PROCESSING**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	3	0	0	3	
Course Objectives	The objectives of this course are to • To Introduce fundamentals of Adaptive filtering random process and correlation. • Provide knowledge of Wiener and LMS adaptive filtering techniques. • Develop understanding of advanced adaptive algorithms and signal space concepts • Familiarize with lattice filters and adaptive signal estimation methods.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define adaptive signal processing concepts, characteristics and its application.
CO2	Explain the various mathematical models to adaptive signal processing..
CO3	Apply simulation tools for adaptive signal processing in communication systems.
CO4	Analyze nonlinear control and the need for real-time parameter adaptation. .

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Adaptive Systems**: Definitions, characteristics, and applications (adaptive noise cancellation, channel equalization, echo cancellation), . Open and closed loop adaptation, and its applications, The adaptive Linear combiner: Description, weight vector, Desire response, performancefunction, Gradient and mean square error.

Unit-II	I**ntroduction to Filtering**: Smoothing and Prediction-Linear Optimum Filtering, Problem Statement, Principle of Orthogonality, Minimum– Mean-Squared Error, Wiener –Hopf Equations, Error Performance, Normal Equation. Transversal filters, lattice filters, and their adaptive implementations. FFT based adaptive kalman filter, Kalman Filtering Problem.
Unit-III	**ADAPTIVE MODELING AND SYSTEM IDENTIFICATION**: General description, adaptive modeling of multipath communication channel, adaptive modeling in geophysical exploration, adaptive modeling in FIR digital filter synthesis, general description of inverse modeling.
Unit-IV	**Adaptive Algorithms** :LMS algorithm (real and complex signals) ,Recursive least squares algorithm (RLS),Comparison of LMS and RLS ,Adaptive equalization in communication systems, Stability and Performance Analysis of LMS Algorithms, LMS Gradient and Stochastic Algorithms, Convergence of LMS Algorithms,

Suggested Readings:

- Adaptive Signal Processing by BernandWidrow, Pearson Education, Asia.2009
- Adaptive filter by SimonHaykins , PHI.2003.
- Adaptive Signal Processing by Aurelio Uncini,
- Adaptive Signal Processing: by Tulay Adali & Simon Haykin (2010,
- Adaptive Signal Processing by S. Thomas Alexander, SpringerVerlag.
- Adaptive Signal Processing by TulayAdali, Simon Haykin , Wiley Publications, 2012.
- Basic Adaptive Signal Processing and its MATLAB Simulation by Alexander D. Poularikas ,1st Edition,

Useful Video Links:

Unit No	Topics	Links
Unit-I	Definition and characteristics of Adaptive signal processing	Introduction To Adaptive Signal Processing - Course
Unit-II	Wiener filters (FIR and IIR)	https://youtu.be/9yNQBWKRSs4?si=lXPfUmXBHReWCNj4
Unit-III	FFT Filters	https://youtu.be/QmgJmh2I3Fw?si=vjwobjXqgHILNv0s
Unit-IV	Adaptive Filter	https://youtu.be/QPTnIMn63Vw?si=JGH6oc7BkDs1t1or

Course Code	**PEC-ECE-316A**				
Category	Professional Elective Courses				
Course Title	**WIRELESS COMMUNICATION**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are to ● To understand wireless communication principles and propagation models. ● To study wireless networking and multiplexing techniques. ● To learn multiple access methods and cellular technologies. ● To explore diversity, OFDM, and MIMO communication techniques.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the principles of wireless communication systems, propagation models and channel characteristics for analyzing wireless transmission performance.
CO2	Understand and Apply multiplexing methods and wireless networking protocols in wireless communication systems.
CO3	Apply multiple access and cellular communication techniques in wireless systems.
CO4	Analyze diversity techniques and MIMO-based signal processing methods for improving wireless system performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Review of Digital Communications** - Components of a Wireless Transmitter and Receiver – Bandwidth, Duplexing, Licensed and Unlicensed Bands - Power, Rate and SNR - Shannon's Capacity, Bandwidth and Power Limited Regimes - Radio Propagation and Propagation PathLoss Model: Free-Space Attenuation, Multipath Channel Characteristics, Introduction to wireless communication systems: Evaluation of mobile radio communications, examples of wireless communication systems, paging systems, cordless telephone systems, compression of various wireless systems.

Unit-II	**Types of Multiplexing:** Fixed Assignment vs. Statistical Multiplexing - Aloha, Slotted Aloha - CSMA with Collision Avoidance and Collision Detection - WIFI: History and Motivation, Architecture, Wireless Personal Area Networks (PANS): Bluetooth 802.15.1, Zigbee 802.15.4.
Unit-III	**Multiple access techniques in wireless communication:** contention-free multiple access schemes (FDMA TDMA, CDMA, SDMA and Hybrid) Mobile wireless communication systems: second generation cellular networks, third generation wireless networks, fourth generation wireless networks. Recent wireless technologies: multicarrier modulation, OFDM, MIMO system.
Unit-IV	**Diversity Techniques**- Polarization Diversity, Frequency Diversity, Time Diversity, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, spatial multiplexing, MIMO and space time signal processing. Text Books/Reference Books 1. Vijay K Garg, "Wireless Communications and Networks", Morgan K

Suggested Readings:

- Wireless Communications and Networks by Vijay K Garg,, Morgan KaufmannPublishers an Imprint of Elsevier, USA 2009 (Indian reprint)
- Introduction to Wireless and Mobile Systems by D. P. Agrawal and Q.-A. Zeng, ThirdEdition, Cengage Learning, 2010
- Wireless Communications & Networks by W. Stallings,Second Edition, Prentice Hall,2004.
- Wireless Communications by T. S. Rappaport, Second Edition, Prentice Hall, 2002
- Mobile Communications by J. Schiller, Second Edition, Addison Wesley, 2003

Useful Video Links:

Unit No	Topics	Links
Unit-I	Components of a Wireless Transmitter and Receiver	https://www.youtube.com/watch?v=iY6RHALuOzE
	Shannon's Capacity	https://www.youtube.com/watch?v=lQHjREaGJVc
Unit-II	Wireless Personal Area Networks (PANS)	https://www.youtube.com/watch?v=XB479LeOvRw
	Fixed Assignment vs. Statistical Multiplexing	https://www.youtube.com/watch?v=7i-72hsmWTQ
Unit-III	Fourth generation wireless networks	https://www.youtube.com/watch?v=UtIl6v-CBCI
	Multicarrier modulation	https://www.youtube.com/watch?v=6mjaAc1P59A
Unit-IV	Space time signal processing	https://www.youtube.com/watch?v=cIH5o7wYNzs&t=82s
	Practical Space Diversity	https://www.youtube.com/watch?v=MFaxyD-p80M

Course Code	**PEC-ECE-318A**				
Category	Professional Elective Courses				
Course Title	**TELECOMMUNICATION AND SWITCHING NETWORKS**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are to • To understand the fundamentals of telecommunication systems used in modern communication systems. • To Study telecommunication traffic and multiplexing methods used in network communication. • To study electronic and stored program controlled telephone exchanges with digital switching systems. • To understand signaling systems and network protocols of modern communication networks.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the evolution of telecommunication systems, telephone networks, switching techniques, and subscriber loop design.
CO2	Interpret telecommunication traffic models and operation of circuit, space, time and hybrid switching systems.
CO3	Describe the working of electronic exchanges and digital switching systems used in modern telecommunication networks.
CO4	Analyze signaling systems, network protocols, LAN architectures, and the evolution of communication networks towards ISDN.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction: Evolution of Telecommunication, Switching System, Classification ofSwitching, Types of Telephone Switching Systems, Elements of Telecommunication,Telecommunication Standard. Telephone System: PSTN, Modern Telecom System,Telephone Network, Telephone Set, Telephone Network organization, Principles andexamples of step by step, Cross bar and reed relay systems, Central Battery System, Transmission impairments, Two-four-wire transmission, Subscriber Loop Design.

Unit-II	Telecommunication traffic: Telecommunication traffic, Traffic considerations, Erlang, Grade of Service, Traffic Measurement, Switching System: Resource sharing and need for switching, Need for Networks, Switching, Types of Switching, Circuit Switching, Message Packet Switching, Function of Switching System, Electronic Switching System, Multiplexing- TDM,FDM, Implementation of Switching System, Blocking and Non-blocking Switches, Single & Multi stage Switches, Space Switching, Time Switching, Hybrid Switching, Path finding, Complexity, Blocking Probability of Switch.
Unit-III	Telephone Exchange: Stored Program Controlled Exchange, Electronic Exchange, Electronic Switching & Stored Program Control Systems, Digital Switching Time, Space & Hybrid Switches, Example of Digital Exchanges, Example of Modern Exchanges (C-DOI exchange), Availability of Parallel Exchange.
Unit-IV	Signaling Systems: Signaling, Types of Signaling information, Forms of Signaling, Channel Associated Signaling (CAS), Common Channel Signaling, CCITT No-7 System, SS7 Signaling, Architecture Computer & Data Networks, ARPANET, ALOHA-Toke Protocols Network Topology, Multiple Access Schemes, Layered Architectures, Networks Protocols, Local Area Network, Evolution towards ISDN.

Suggested Readings:

- J. E. Flood,, Telecommunication and Switching Traffic & Networks, Pearson Education , 2001
- Thiagarajan Viswanathan, Telecommunication Switching Systems & Networks, PHI , 2006
- P. Gnanasivam,Telecommunication Switching Systems & Networks, Pearson Education

Useful Video Links:

Unit No	Topics	Links
Unit-I	Evolution of Telecommunication	https://www.youtube.com/watch?v=IVOg-TdBx-M
Unit-II	Telecommunication traffic	https://www.youtube.com/watch?v=bU3jr-CrE9g
Unit-III	Electronic Switching & Stored Program Control Systems	https://www.youtube.com/watch?v=XIJviYQebZY
Unit-IV	Types of Signaling information	https://www.youtube.com/watch?v=zmdfJ-wcKzI

Course Code	**LC-ECE-320A**					
Category	Professional Core Courses					
Course Title	**DIGITAL SIGNAL PROCESSING LAB**					
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**	
	0	0	2	1		
Course Objectives	The objectives of this course are to ● Get the knowledge of MATLAB for developing signal processing applications. ● To learn various signal processing techniques through practical applications.					
Assessment	25 Marks					
End Semester Examination	25 Marks					
Total	50 Marks					
Duration of Exam						

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Describe the functionality of MATLAB for representing signals in various signal processing applications for practical problem-solving.
CO2	Implement Z-Transform, DFT and FFT techniques for discrete-time signals to analyze their frequency-domain characteristics.
CO3	Develop algorithms for designing and implementation of FIR and IIR filters using standard techniques.
CO4	Analyze the effect of noise on the performance of the signals.

List of Experiments

Sr. No.	**Contents**
1	Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2	To develop program for Z-Transform.
3	To develop program for Convolution of sequences.
4	To develop program for Correlation of sequences.
5	To develop program for DFT & IDFT of two sequences.
6	To develop program for FFT of two Sequences.
7	To develop program for Circular Convolution.
8	To design analog filter (low-pass, high pass, band-pass, band-stop).
9	To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10	To develop program for Interpolation and Decimation of sequences.
11	To design FIR filters using windows technique.
12	Detection of Signals buried in Noise.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)	Generating Basic sequences (step, impulse, ramp, exponential) using MATLAB || Part-2 || let'sdECodE 8. MATLAB Tutorial | Basic Signals: Step, Impulse, Sine, and Square
2	To develop program for Z-Transform	z transform in MATLAB| MATLAB code for z transform| z transform using MATLAB| ztrans command
3	To develop program for Convolution of sequences	convolution of two sequences in Matlab...
4	To develop program for Correlation of sequences	Cross Correlation in MATLAB | Cross Correlation Function | MATLAB Tutorial for Beginners in Hindi
5	To develop program for DFT & IDFT of two sequences	EE 407: DSP Computing DFT and IDFT using Matlab
6	To develop program for FFT of two Sequences	How to Do FFT in MATLAB
7	To develop program for Circular Convolution	MATLAB Program Circular Convolution using DFT
8	To design analog filter (low-pass, high pass, band-pass, band-stop).	Bandpass filter from High pass and low pass filter | MATLAB
9	To design digital IIR filters (low-pass, high pass, band-pass, band-stop).	https://www.youtube.com/watch?v=VFt3UVw7VrE

Course Code	**LC-ECE-322A**				
Category	Professional Core Courses				
Course Title	**CMOS DESIGN LAB**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	0	0	2	1	
Course Objectives	The objectives of this course are to ● To provide knowledge of CMOS devices, PMOS and NMOS layout design ● To introduce CMOS schematic design, layout generation, and simulation of basic digital circuits ● To explain the design and verification of combinational circuits including adder and subtractor ● To provide understanding of analog CMOS circuit design and simulation of differential amplifiers				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Explain PMOS and NMOS circuit and its characteristics with performance parameters
CO2	Examine and simulate CMOS schematic and layout of basic logic gates such as inverter, NAND and NOR circuits.
CO3	Demonstrate CMOS-based combinational circuits including adder and multiplexer using truth tables and transient analysis.
CO4	Analyze analog CMOS circuits such as differential amplifiers to achieve specified gain and performance requirements.

List of Experiments

Sr. No.	**Contents**
1	Write a spice programme for CMOS inverter with following details. pmos L = .8ym W=12.0um, nmos = 8um W=2.4um, nmos (kp=60u Vto=0.6v) pmos(kp=20u Vto=-0.8v)
2	Write a spice programme for CMOS nand gate with following details: Vdd=5volt, pmos L=.8umW=20um,nmos L=8umW=um, nmos (kp=45u V to = 1.0v) pmos (kp=25u Vto=-1.2v)
3	Write a spice programme for CMOS nor gate with following details: Vdd=5volt, pmos L=.8umW=20um,nmos L=8umW=um, nmos (kp=45u V to = 1.0v) pmos (kp=25u Vto=-1.2v)
4	Design a full adder using half adder circuit.
5	Design the layout for PMOS in layout editor
6	Design the Layout for NMOS in layout editor
7	Design the layout for CMOS inverter with equal rise and fall time in layout editor
8	Draw the CMOS schematic and Layout of the inverter circuit, simulate both schematic and layout to determine propagation delay, rise time fall time and Q point and comment on the results

9	Draw the CMOS schematic of the 2 input NAND and NOR gate, also draw the layout of the same, and simulate for transient result
10	Draw the CMOS schematic of the Half Adder circuit and verify its truth table and also draw the layout and simulate for transient results.
11	Draw the CMOS circuit of the 2:1 Multiplexer circuit and verify its truth table and also draw the layout and simulate for transient results.
12	Design the Differential amplifier schematic for a gain of 50dB

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Design a full adder using half adder circuit	https://www.youtube.com/watch?v=CiJcMP6V-ro
2	Design the layout for PMOS in layout editor	https://www.youtube.com/watch?v=1JGBk5R3WSo
3	Design the Layout for NMOS in layout editor	https://www.youtube.com/watch?v=1JGBk5R3WSo
4	Design the layout for CMOS inverter with equal rise and fall time in layout editor	https://www.youtube.com/watch?v=nQ3zudQGyow

Course Code	**PROJ-ECE-324A**				
Category	Project				
Course Title	**MINI PROJECT - II**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	0	0	2	1	
Course Objectives	The objectives of this course are to ● To expose students to domains related to real-world engineering problems. ● To introduce structured approaches for project planning, execution, documentation and technical presentation. ● To enable the use of engineering concepts, tools and technologies for developing practical project solutions. ● To create awareness of ethical, economic, environmental, and sustainability considerations in engineering projects.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify and summarize the problem statement, hardware & software tools and relevant domain for project work planning.
CO2	Develop skills to write technical reports and deliver effective presentations.
CO3	Apply engineering principles and ethics to address real-world problems and foster lifelong learning.
CO4	Implement skills to manage the problem encountered by individuals and as a team for better resource utilization.
CO5	Analyze and assess methods and parameters for optimized resource utilization to ensure an efficient technical solution.
CO6	Design and develop innovative, sustainable, cost-effective and environment friendly solutions to real world problems for societal benefits.

Guidelines:

1. The Mini/Micro Project shall be carried out as a team activity comprising 2 to 4 students, focusing on real-life problems using electronic devices and systems.
2. The project may involve complete hardware or a combination of hardware and software, with the software component limited to less than 50% of the total work.

3. After consultation with the project guide and based on literature survey and need analysis, students shall finalize the project title, aim, and objectives.
4. Students are required to prepare a project proposal in the early phase of the semester, including specifications, methodology, required resources, and critical design/implementation issues.
5. The project work shall involve design, development, and testing as per the planned schedule.
6. Circuit design, artwork, and layout should be carried out using CAD-based PCB design and simulation software.
7. The completed project, along with documentation in the form of a project report, must be submitted at the end of the semester.
8. Available sessions may be utilized for discussions on standard design practices, PCB design techniques, product development approach, and report writing guidelines.

Useful Video Links:

Details of Links
• https://www.youtube.com/@EEVblog • https://www.youtube.com/@greatscottlab • https://www.youtube.com/@allaboutelectronics • https://www.youtube.com/@mcwhorpj • https://www.youtube.com/@Dronebotworkshop • https://www.youtube.com/@AndreasSpiess • https://www.youtube.com/@StuffMadeHere • https://www.youtube.com/@hacksmith • https://www.youtube.com/@allenpan • https://www.youtube.com/@ElectroBOOM • https://www.youtube.com/@adafruit • https://www.youtube.com/@sciguy14 • https://www.youtube.com/watch?v=jtpqsVKtu9Y • https://aislyn.in/project-ideas/electronics-communication-engineering-ideas • https://www.electronicsforu.com/electronics-projects/hardware-diy/ece-projects • https://www.youtube.com/watch?v=5ArmM80YMSM

Course Code	**SM-ECE-326A**				
Category	Seminar				
Course Title	**SEMINAR**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	0	0	2	1	
Course Objectives	The objectives of this course are to • To develop technical presentation and professional communication skills. • To enhance the ability to review and interpret technical literature from research and industry sources. • To promote awareness of emerging technologies and contemporary engineering developments. • To strengthen technical report writing, documentation, and discussion skills.				
Assessment	50 Marks				
End Semester Examination	--				
Total	50 Marks				
Duration of Exam	--				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify emerging technologies, recent developments, and contemporary issues in engineering.
CO2	Interpret and summarize technical information from research papers, journals, and industry reports.
CO3	Prepare technical reports and deliver effective seminar presentations using appropriate communication tools.
CO4	Show technical knowledge and professional communication skills during seminar discussions and viva-voce.

Guidelines:

- Each student shall select a seminar topic related to Electronics & Communication Engineering or allied emerging technologies in consultation with the faculty mentor.
- The seminar topic should preferably be based on recent research papers, industrial developments, innovative products or emerging technologies.
- Students shall conduct a comprehensive literature survey using journals, conference proceedings, patents, technical magazines and authentic online resources.
- A seminar report shall be prepared in the prescribed format and submitted before the presentation.
- Each student shall deliver an oral presentation followed by a question-and-answer session.
- Evaluation shall be based Technical Knowledge & Conceptual Clarity, Presentation & Communication Skills Technical Discussion & Viva-Voce, Seminar Report Innovation & Future Scope
- Proper citation of references and adherence to academic integrity standards shall be mandatory.
- Students are encouraged to use presentation aids such as slides, demonstrations, simulations, videos, or prototypes etc. wherever applicable.
- The seminar shall aim to enhance technical knowledge, communication skills, critical thinking and lifelong learning abilities.

Annexure AC/5.5

~~Annexure 4.4~~

Course Code	**OEC-01A**				
Category	Open Elective Course				
Course Title	**Engineering Ethics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand ethical principles, moral reasoning, and professional responsibilities in engineering practice and decision-making. ● To gain knowledge of ethical awareness in professional and research practices. ● To learn the role of engineers in society, environmental & corporate responsibility, and global justice.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Levels
CO1	Identify risks and safety measures for ethically sound technical solutions.	L1 (Remembering)
CO2	Describe various ethical practices for promoting professionalism and environment sustainability.	L2 (Understanding)
CO3	Examine engineering dilemmas, moral reasoning and ethical issues in digital platforms.	L3 (Applying)
CO4	Analyze global situations and make responsible decisions to ensure research integrity and social well-being.	L4 (Analyzing)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Ethics and Professionalism:** Ethics and Excellence in Engineering, Micro and Macro Issues, Dimensions of Engineering, Potential Moral Problems, What Is Engineering Ethics, Why Study Engineering Ethics? Responsible Professionals, Professions, and Corporations: Saving Citicorp Tower, Meanings of Responsibility, Engineering as a Profession, Ethical Corporations and Senses of Corporate Responsibility. Moral Reasoning and Codes Ethics, Moral Choices and Ethical Dilemmas, Rights Ethics, Duty Ethics, Utilitarianism, Virtue Ethics, Self-Realization Ethics, Ethical Egoism, Which Ethical Theory Is Best?

Unit-II	**Engineering as Social Experimentation:** Engineering as Experimentation, Engineers as Responsible Experimenter, Commitment to Safety: The Concept of Safety, Risks, Acceptability of Risk, Assessing and Reducing Risk: Uncertainties in Design, Risk-Benefit Analyses, Personal Risk versus Public Risk, Examples of Improved Safety, Three Mile Island, Safe Exits.
Unit-III	**Truth and Truthfulness**: Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Common Sense Procedures, Beyond Whistle-Blowing, Honesty and Research Integrity: Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity, Bias and Self-Deception, Protecting Research Subjects, Giving and Claiming Credit. Computer Ethics: The Internet and Free Speech, Power Relationships, Property, Privacy, Additional Issues.
Unit-IV	**Environmental Ethics**: Engineering, Ecology, and Economics, Environmental Moral Frameworks, Human-Centered Ethics, Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives. Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology, Bhopal, "When in Rome", International Rights, Promoting Morally Just Measures, Weapons Development and Peace, Involvement in Weapons Work, Defense Industry Problems, Peace Engineering.

Suggested Readings:

- Introduction to Engineering Ethics by Mike W. Martin and Roland Schinzinger, McGraw Hill, New Delhi, latest edition
- Engineering Ethics by Govindarajan M, Natarajan S, Senthil Kumar V. S, Prentice Hallof India, New Delhi, latest edition
- Engineering Ethics by Charles B. Fleddermann, Senthil Kumar V. S, Prentice Hallof India, New Delhi, latest edition
- Ethics and the Conduct of Business by John R Boatright, Pearson Education, NewDelhi, latest edition
- Fundamentals of Ethics for Scientists and Engineers by Edmund G Seebauer and Robert L Barry, Oxford University Press, Oxford, latest edition
- Business Ethics: Decision Making for Personal Integrity and Social Responsibility by Laura P. Hartman and Joe Desjardins, Mc Graw Hill education, India Pvt. Ltd., New Delhi latest edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Ethics and Professionalism	https://www.youtube.com/watch?v=rI1urvmVfVI
Unit-II	Engineering as Social Experimentation	https://www.youtube.com/watch?v=-GJ7V6XV5H4
Unit-III	Whistle-Blowing, Moral guidelines, Protecting Whistle-Blowers,	https://www.youtube.com/watch?v=JGtrWVD5xmk https://www.youtube.com/watch?v=tbYegQf6ERg
	Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity,	https://www.youtube.com/watch?v=r SMybaviUVY
Unit-IV	Environmental Ethics Responsibility to Environment. Ecology, and Economics	https://www.youtube.com/watch?v=urY5quh6Ym8 https://www.youtube.com/watch?v=IbJysNlSG7Y
	Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology	https://onlinecourses.nptel.ac.in/noc19_ge23/preview http://www.digimat.in/nptel/courses/video/110105081/L42.html

Course Code	**OEC-06A**				
Category	Open Elective Courses				
Course Title	**United Nations Sustainable Development Goals**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	3	0	0	3	
Course Objectives	The objectives of this course are to: • Develop an understanding of sustainable development goals (SDGs) in global and Indian perspectives. • Familiarize students with sustainable resource management, circular economy, sustainable production and consumption and renewable energy. • Provide knowledge of climate change, sustainable energy, corporate social responsibility and life cycle assessment for sustainable development.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Levels
CO1	**Describe** the concepts, terminologies and importance of sustainable development.	L1 (Remembering)
CO2	**Explain** sustainability issues from environmental, social and economic perspectives.	L2 (Understanding)
CO3	**Apply** sustainability principles and practices to identify and address real-world challenges.	L3 (Applying)
CO4	**Analyze** sustainable development challenges and strategies for achieving long-term sustainability.	L4 (Analyzing)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 mark each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Sustainable Development:** Need and Importance of Sustainable Development, Historical and Policy Perspectives of Sustainable Development, Sustainable Development: Global and Indian Perspectives. **Introduction to the 17 Sustainable Development Goals (SDGs):** Objectives of the Different SDGs, Challenges and Strategies for Achieving the Sustainable Development Goals.
Unit-II	**SDG 4: Quality Education and Lifelong Learning:** Focus of NEP-2020 on SDGs, Education for Sustainable Development (ESD), Berlin Declaration 2021 on ESD, Tools, Systems and Innovation for Sustainability,Sustainability Measurement: Indicators, Uses and Applications.

Unit-III	**Sustainable Resource Management in SDGs:**Current Economic Issues in the Context of Global Sustainable Development, Circular Economy: Principles of Reduce, Reuse, and Recycle (3Rs),Rural and Urban Sustainability Problems and Challenges. **Sustainable production and consumption**: Importance of Sustainable Production and Consumption, Renewable Energy Resources, Health and Hygiene, Water, Sanitation and Water Resource Management, Waste Management.
Unit-IV	**Climate Change, Energy and Sustainable Development:** The greenhouse effect: Causes and Consequences, Climate Change as a Threat to Sustainable Development; Adaptation to Current and Future Climate Regimes, Sustainable Energy and Climate Change Mitigation. **Sustainable Business Practices:** Corporate Social Responsibility, Sustainable Products and Services, Business and Environmental Sustainability, Corporations and Ecological Sustainability, Life Cycle Assessment (LCA): Overview and Applications.

Suggested Readings:

- Energy, Environment and Sustainable Development: Issues and Policies by S.Ramaswamy sathis, Regal Publication.
- The Economics of Sustainable Development: The Case of India by Surender Kumar and Shunsuke Managi , Springer Publication, Switzerland
- Corporate Social Responsibility in Developing and Emerging Markets by OnyekaOsuji, Cambridge Publication.
- Environmental Ecology, Biodiversity and Climate Change by H MSaxena, Rawat Publication.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Need and Importance of Sustainable Development	https://www.youtube.com/watch?v=rMh4LmwvMAg
Unit-II	Education for Sustainable Development (ESD)	https://www.youtube.com/watch?v=NFKYks8-xVg
Unit-III	Sustainable production and consumption	https://www.youtube.com/watch?v=PS1ffI6K6Fc
Unit-IV	Climate Change, Energy and Sustainable Development	https://www.youtube.com/watch?v=LEFhb51q3Sg

Annexure AC/5.6

~~Annexure 4.5~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)
(An Autonomous Institute)

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations

(Under NEP-2020)

B-SCHEME

Bachelor of Technology (Electronics and Communication Engineering)

2nd Year

(Academic Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Hr. Lecture (L) per week	1 Credit
2	1 Hr. Tutorial (T) per week	1 Credit
3	2 Hr. Practical (Lab) per week	1 Credit
4	2 Hr. Project per Week	1 Credit

2. RANGE OF CREDIT

As per AICTE guidelines, a student shall be eligible to receive an Undergraduate Degree with Honors/Minors/Specialization upon earning additional 18-20 credits beyond the prescribed about 160 major credits. The minor variation is allowed as per the need of the respective disciplines.

However the Board of Studies after deliberation and discussion framed the curriculum and scheme of Examination has finalized 170 credits for the award of Undergraduate Degree (B.Tech in Electronics & Communication Engineering.) and additional 20 credits for B.Tech Honors/Minors/Specialization. Furthermore as per the AICTE/UGC SWAYAM Credit Framework Regulations, credit transfer for SWAYAM/NPTEL courses is permitted subject to the approval of the Chairperson, Board of Studies (BOS). A classroom course may be considered equivalent to a SWAYAM/NPTEL course if a majority of the course contents and syllabus components are substantially similar.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B. TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	69
2	Professional Elective Courses (Relevant to chosen specialization/branch)	12
3	Multidisciplinary Open Elective Courses	09
4	Basic Science Courses	21
5	Engineering Science Courses	25
6	Humanities and Social Sciences including Management courses	12
7	Training/Seminar/Internship/Project	20
8	Value Added Courses	2
9	Mandatory Courses	Non-Credit
	Total Credits	**170**

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses (Theory Courses)	PCC
2	Professional Core Courses (Lab Courses)	LC
3	Professional Elective Courses (Relevant to chosen specialization/branch)	PEC
4	Multidisciplinary Open Elective Courses	OEC
5	Basic Science Courses	BSC
6	Engineering Science Courses	ESC
7	Humanities and Social Sciences including Management courses	HSMC
8	Training	PT
9	Seminar	SM
10	Internship	INT
11	Project	PROJ
12	Value Added Courses	VAC
13	Mandatory Courses (Non Credit)	MC

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech (Electronics & Communication Engineering) – 3rd Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in Hours
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core courses	PCC-ECE-201B	Electronic Devices	3	0	0	3	3	30	45		75	3
2	Engineering Science Courses	PCC-CSE-203B	Data Structures	3	0	0	3	3	30	45		75	3
3	Professional Core courses	PCC-ECE-205B	Computer Organization & Architecture	3	0	0	3	3	30	45		75	3
4	Basic Science Courses	BSC-MECE-207B	Mathematics-III	3	1	0	4	4	40	60		100	3
5	Professional Core Courses	PCC-ECE-209B	Signal Systems and Network Analysis	3	1	0	4	4	40	60		100	3
6	Humanities and Social Sciences including Management Courses	HSMC-02B	Economics for Engineers	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-ECE-211B	Electronic Devices Lab	0	0	2	2	1	10	-	15	25	
8	Professional Core Courses	LC-ECE-213B	Signal Systems and Network Analysis Lab	0	0	2	2	1	10	-	15	25	
9	Professional Core Courses	LC-ECE-215B	Electronic Workshop & PCB Design Lab	0	0	2	2	1	10	-	15	25	
10	Mandatory Courses	*MC-201B	Environmental Science	2	0	0	2	-	20	30	-	-	3
Total Credits								**23**				**575**	
NOTE 1: *MC-201B: - It is a mandatory non –credit course in which the students will be required passing marks.													
Minor/Honors (Hons.)/Specialization in VLSI Design and Technology													
I	Classroom OR MOOCs	Refer to Annexure-I	Minor/Honors (Hons.)/Specialization (Table –II)	4	0	0	4	4	40	60		100	3

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech (Electronics & Communication Engineering) – 4th Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in Hours
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ECE-202B	Analog & Digital Communication	3	0	0	3	3	30	45	-	75	3
2	Professional Core Courses	PCC-ECE-204B	Analog Electronic Circuits	3	0	0	3	3	30	45	-	75	3
3	Professional Core Courses	PCC-ECE-206B	Digital Electronics	3	1	0	4	4	40	60	-	100	3
4	Professional Core Courses	PCC-ECE-208B	Microprocessor and Microcontroller	3	0	0	3	3	30	45	-	75	3
5	Professional Elective Courses	Refer to Annexure-I	Professional Elective (Table –I)	3	0	0	3	3	30	45	-	75	3
6.	Humanities and Social Sciences including Management Courses	HSMC-01B	Fundamental of Management and Organizational Behavior	3	0	0	3	3	30	45	-	75	3
7.	Professional Core Courses	LC-ECE-218B	Analog & Digital Communication lab	0	0	2	2	1	10	-	15	25	-
8.	Professional Core Courses	LC-ECE-220B	Analog Electronics Circuit Lab	0	0	2	2	1	10	-	15	25	-
9.	Professional Core Courses	LC-ECE-222B	Digital Electronics Lab	0	0	2	2	1	10	-	15	25	-
10.	Professional Core Courses	LC-ECE-224B	Microprocessor and Microcontroller Lab	0	0	2	2	1	10	-	15	25	-
11.	Project	*PROJ-226B	Project Based Learning/Micro Project	0	0	2	2	1	25	-	-	25	-
Total Credits								**24**				**600**	

NOTE 1: *PROJ-226B: - It is an innovative learning approach in which students actively participate in real-world projects, micro projects, and demonstrations to solve practical problems. This approach fosters critical thinking, creativity, teamwork and hands-on technical skills while encouraging experiential, application-oriented and self-directed learning. The evaluation will be carried out on the basis of specified rubrics.

NOTE 2: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/Professional Organization/ Research Laboratory/ training centre etc. and submit a report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

NOTE 3: Students must choose one course from the Professional Elective–I category (Table I). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Minor/Honors (Hons.)/Specialization in VLSI Design and Technology

I	Classroom	MLECEVLSI-203B	Digital Design with Verilog Lab	0	0	2	2	1	10	-	15	25	-
II	Classroom OR MOOCs	Refer to Annexure-I	Minor/Honors (Hons.)/Specialization (Table –II)	4	0	0	4	4	40	60	-	100	3

Annexure-I

Professional Elective Courses (Table-I)

S. No	Course Code	Course Name
1	PEC-ECE-210B	Scientific Computing
2	PEC-ECE-212B	Power Electronics
3	PEC-ECE-214B	Introduction to Artificial Intelligence
4	PEC-ECE-216B	Introduction to MEMS
5	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Minor/Honors (Hons.)/Specialization in VLSI Design and Technology (Table-II)

S. No	Course Code	Course Name
1	#MECEVLSI-201B	VLSI Technology
2	#MECEVLSI-202B	Digital Design with Verilog

#Note 1: The above course may be altered in even/odd semester as per availability of courses on NPTEL/Swayam platform with prior approval of the Chairperson of BOS.

 # Note 2: The laboratory course Digital Design with Verilog Lab (MLECEVLSI-204B) shall be offered along with the theory course Digital Design with Verilog (MECEVLSI-202B) in the same semester, subject to the availability of the theory course on the NPTEL/SWAYAM platform and with the prior approval of the Chairperson, Board of Studies (BoS).

Course Code	**PCC-ECE-201B**				
Category	Professional Core Courses				
Course Title	**Electronic Devices**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand the fundamental concepts and operating principles of semiconductor devices. ● To study the characteristics and practical applications of various semiconductor devices. ● To design and analyze basic electronic circuits using semiconductor components. ● To explore biasing techniques and equivalent models for device operation in amplification and switching applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to:

COs	Skills Demonstrated
CO1	Understand and apply the fundamental concepts, working operations and characteristics of semiconductor devices to design electronic circuits and systems.
CO2	Apply diode principles to design and analyze its applications in rectifiers, Clippers, Clampers, filters, voltage doubler circuits.
CO3	Analyze biasing techniques used in amplifiers to determine their stability conditions for establishing a proper operating point.
CO4	Describe the working principles and applications of special purpose semiconductor devices used in electronics circuits.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Basic Semiconductor And PN-Junction Theory:** Introduction, Atomic Structure, Band Theory of Semiconductors, Effect of Temperature on Conduction, Drift Current, Donor & Accepter Impurities in Semiconductor, Law of Mass Action, Hall's Effect, Hall Coefficient & Mobility, continuity equation. **Characteristics Of Diode:** PN-Junction, Construction Types, Unbiased Junction, Biased Junction, Space Charge Region, Diode Characteristics & Parameters, Diode Capacitance, Diode Resistance, DC And AC Load Lines, Diode Testing, Zener And Avalanche Breakdown Diodes, Temperature Characteristics of Diode, Reverse Recovery Time, Switching Characteristics of Diode.

Unit-II	**Diode Applications:** Half Wave, Full Wave Center Tapped, Full Wave Bridge(Rectification), Series Clipping Circuit, Shunt Clipping Circuit, Clamping Circuit, Bridge Voltage Doubler, Filtering Circuit Using Capacitor & Inductor. **Special Semiconductor Devices:** Optoelectronic Devices, Photoconductors, Photo Diode, Photo Voltaic Sensor, Solar Cells, LED, LCD, Laser Diode, Schottky Diode, Tunnel Diode ,SCR, TRIAC, DIAC, UJT, IGBT, Opto Coupler.
Unit-III	**Junction Transistor:** Introduction, Construction Of Junction Transistor, Circuit Symbols, Transistor Operation, Unbiased Transistor, Operation Of Biased Transistor, Transistor Current Components, DC & AC Load Line, Operating Point, Transistor Configuration CB, CE, CC, Input/Output Characteristics, Early Effect(Base Width Modulation), Eber's-Moll-Model of Transistor, Maximum Rating of Transistor, Transistor Testing, Transistor as an amplifier. **BJT Biasing:** Bias Stability, Instability Due To β, Thermal Stability, Stability Factor, Fixed Biased Circuits, Effect of Emitter Resistor, Collector to Base Bias, Voltage Divider Biasing, Advantage & drawbacks of Biasing Techniques, Stability Factor calculation of Biasing Techniques, Bias Compensation by various device, Thermal Runway, Transistor Dissipation, Thermal Resistance, Condition of Thermal Stability.
Unit-IV	**Small Signal Circuit:** Two Port Network, Hybrid (H-Parameter) Model, Typical Values of H-Parameter Model, Conversion of CE, CB, CC Configuration to Equivalent Hybrid Model, CB Circuit Analysis, CE circuit with & without R_E analysis, CC circuit analysis, Analysis of CE, CB & CC Configuration with approximate Hybrid Model, Miller's Theorem, Dual of Miller Theorem. **FET:** Introduction, The Junction FET, Basic Construction, Operation, P- Channel FET, N-Channel FET, High Frequency Model of FET, Low Frequency FET Amplifiers, Transfer Characteristics of FET. JFET and MOSFET Structure, Operation and characteristics.

Suggested Readings:

- Electronics Device &Circuit by J.B. Gupta -S.K. Kataria and Sons.
- Electronics Device &Circuit by Sahdev, S.K 2nd Edition—DhanpatRai& sons.
- Integrated Electronics by Millman Halkias -- TMH.
- Electronics Device Circuit by David. A. Bell -- Oxford.
- Principal of Electronics Device & Circuit by Theraja , B.L, Sedha, RS, S Chand.
- Electronics Device &Circuit by Maini, A.K; Agarwal, Varsha—-Wiley India.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Basic Semiconductor Introduction	https://youtu.be/CXFtbpYaBXw?si=yAkLNOIiRFCCo7te
	Characteristics of Diode	https://youtu.be/OkyKCNvKJI4?si=zAN6-T2SNOou2hkI
Unit-II	Clipper Circuit	https://www.youtube.com/watch?v=1hfhih839oU
	Special Semiconductor Devices	https://www.youtube.com/watch?v=o_d9j67Zm7k
Unit-III	Introduction to BJT	https://youtu.be/qFaAk9YPURw?si=74PmQzvApKquQF1R
	Transistor Configuration	https://www.youtube.com/watch?v=x8WxZjKrvTc
	BJT Biasing	https://www.youtube.com/watch?v=1vRgDzJ2yOU
Unit-IV	H-parameter	https://youtu.be/N5YIsvY5uBM?si=AAdMvHVVN_mNKG00
	Small Signal Amplifier	https://www.youtube.com/watch?v=5MLVr9r6Vzk&list=PL-IC1WV1OE4kRdcpTfgtNjFpR8XEpDu7O

Course Code	**PCC-CSE-203B**				
Category	Engineering Science Courses				
Course Title	**Data Structures**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are to ● To introduce the basics of data structures and algorithms. ● To explain stacks, linked lists and trees with their implementation. ● To understand sorting, hashing and graph algorithms with complexity analysis. ● To evaluate algorithm efficiency in terms of time and space complexity.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define the key terminologies of data structures and algorithms including their classifications, operations, and performance characteristics.
CO2	Describe the design and implementation of various linear and non-linear data structures, and their real-world applications including hashing and binary trees.
CO3	Apply appropriate data structures such as arrays, stacks, queues, linked lists, trees, and graphs to solve computational problems effectively.
CO4	Analyze the efficiency of algorithms and operations in searching, sorting, and traversals using time and space complexity metrics.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction:** Basic Terminologies: Concept of Data Structure, Choice of right Data Structure, Algorithms, how to design and develop algorithm, Complexity of algorithm. Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Searching: Linear Search and Binary Search Techniques and their complexity analysis. Arrays: Array Definition, Types, Operations on array and their complexity analysis.
Unit-II	**Stacks and Queues:** Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation -corresponding algorithms and complexity analysis. Tower of Hanoi problem. Queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

Unit-III	**Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. **Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Path length, Huffman's algorithm, Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.
Unit-IV	**Sorting and Hashing:** Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. **Graph:** Basic Terminologies, Sequential representation of graphs, Adjacency matrices. Graph search and traversal algorithms and complexity analysis.

Suggested Readings:

- Fundamentals of Data Structures by Ellis Horowitz, Tata McGraw-Hill
- Algorithms, Data Structures, and Problem Solving with C++, by Mark Allen Weiss, Addison-Wesley
- Data Structures and Algorithms by Narasimha Karumanchi.
- Data Structures Using C by Aaron M.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Data Structures and Algorithms	https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F
	Linear Search Algorithm	https://www.youtube.com/watch?v=C46QfTjVCNU
	Binary Search	https://www.youtube.com/watch?v=V_T5NuccwRA
Unit-II	Stacks	https://youtu.be/g1USSZVWDsY?list=PLBF3763AF2E1C572F
	Stack and its Applications	https://www.youtube.com/watch?v=aG0HjeXBUDU
	Queues and Linked Lists	https://youtu.be/PGWZUgzDMYI?list=PLBF3763AF2E1C572F
Unit-III	Linked Lists-I	https://www.youtube.com/watch?v=K7VIKlUdo20
	Trees	https://youtu.be/tORLeHHtazM?list=PLBF3763AF2E1C572F
	Search Trees-II	https://www.youtube.com/watch?v=5jQGqaAUzOI
	AVL Trees	https://youtu.be/mRGQylRWAsI?list=PLBF3763AF2E1C572F
Unit-IV	Sorting	https://youtu.be/4OxBvBXon5w?list=PLBF3763AF2E1C572F
	Hashing	https://www.youtube.com/watch?v=2-h9193Ztqg
	Graphs	https://youtu.be/9zpSs845wf8?list=PLBF3763AF2E1C572F

Course Code	**PCC-ECE-205B**				
Category	Professional Core Courses				
Course Title	**Computer Organization & Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are • To develop understanding of data representation and coding. • To gain knowledge of computer organization and CPU architecture. • To build insight into pipelining and parallel processing. • To acquire familiarity with I/O organization and memory hierarchy.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Apply data representation techniques, register transfer and micro-operations for efficient data processing.
CO2	Analyze instruction codes, registers, memory operations, and I/O mechanisms in optimizing CPU-I/O communication efficiency.
CO3	Apply architectural concepts and parallel processing principles in designing of CPU.
CO4	Describe the hierarchy, types, and operational mechanisms of memory organization for system optimization.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Data representation:** Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes **Register Transfer and Microoperations**: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit-II	**Basic Computer Organization and Design :** Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic. **Central Processing Unit :** General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.
Unit-III	**Pipeline and Vector Processing:** Introduction to Parallel Processors, Amdahl's Law, parallel bus architectures, Parallelism via Instructions -Instruction-Level Parallelism (ILP) Thread-Level Parallelism (TLP) ,Data-Level Parallelism (DLP) Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors, SIMD Array Processors, Pipeline Hazards.
Unit-IV	**Input-output Organization:** I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts. Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

Suggested Readings:

- Computer System Architecture by M.Morris Mano, Pearson
- Computer Organization and Design: The Hardware/Software Interface by David A. Patterson and John L. Hennessy, Elsevier.
- Computer Organization and Embedded Systems by CarlHamacher, McGraw Hill Higher Education.
- Computer Architecture and Organization by latest edition by John P. Hayes, WCB/McGraw-Hill
- Computer Organization and Architecture: Designing for Performance by William Stallings, Pearson Education
- Computer System Design and Architecture by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Useful Video Links:

Unit No.	Topics	Links
Unit I	Data Types	https://www.youtube.com/watch?v=0OoNpd41ZiI
	Error Detection Codes	https://www.youtube.com/watch?v=U7-h2hyM1Dc
	Floating-Point Representation	https://www.youtube.com/watch?v=4gNs7B4ZTjc
	Register Transfer and Microoperations	https://www.youtube.com/watch?v=mNNywW00eEc
Unit II	Instruction Cycle	https://www.youtube.com/watch?v=_W4Yd-yiyog
	Design of Accumulator Logic	https://www.youtube.com/watch?v=Veas4VD5b54
	RISC, CISC	https://www.youtube.com/watch?v=ZW1gb3h-f9k
	Addressing Modes	https://www.youtube.com/watch?v=_CH4cm5PhK8
Unit III	Pipeline and Vector Processing	https://www.youtube.com/watch?v=QLmDUABw0dE
	Array Processors	https://www.youtube.com/watch?v=WIQqig_awGw
	Amdahl's Law	https://www.youtube.com/watch?v=2dYV_lADfFI
Unit IV	Privileged & Non-Privileged Instructions	https://www.youtube.com/watch?v=z0URQryCbI0
	Memory organization	https://www.youtube.com/watch?v=lKVu02WjhoI
	Memory Hierarchy	https://www.youtube.com/watch?v=zwovvWfkuSg

Course Code	**BSC-MECE-207B**				
Category	Basic Science Courses				
Course Title	**Mathematics-III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	4	
Course Objectives	The objectives of this course are • To understand and classify first and second-order linear partial differential equations, and apply appropriate solution techniques including complementary function and particular integral methods. • To solve and analyze physical models such as wave and diffusion equations using methods like separation of variables and D'Alembert's solution.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define partial differential equations and probability distributions, including their properties and physical relevance.
CO2	Solve second-order PDEs using complementary functions and particular integrals.
CO3	Apply probability concepts, including conditional probability and Bayes' Theorem, for real-world problems using discrete and continuous distributions.
CO4	Implement numerical methods (Bisection, Newton-Raphson, Euler, Runge-Kutta) for solving equations and ODEs with a focus on accuracy and efficiency.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Partial Differential Equations**: Partial Differential Equations of higher order, Solution tohomogenous and non-homogenous linear partial differential equations of second order bycomplimentary function and particular integral method, Initial and boundary conditions, D'Alembert's solution of the wave equation, Separation of variables method to simple problems in Cartesian coordinates.
Unit-II	**Probability and Statistics:** Measure of central tendency, Basic concept of Probability, Conditional Probability, Baye's Theore m, Random Variables, Discrete and Continuous Distributions, Binomial, Poisson and Normal Distribution, Linear Regression and Correlation.
Unit-III	**Numerical Methods 1:** Solution of polynomial and transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical differentiation, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules

Unit-IV	**Numerical Methods 2:** Taylor's series, Euler and modified Euler's methods, Runge-Kutta method of fourth order for solving first and second order ordinary differential equations. Matrix inversion (Gauss Seidel, Gauss Elimination Method, LU Decomposition).

Suggested Readings:

- Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons
- Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers
- Higher Engineering Mathematics by B. V. Ramana, TMH
- A text book of Engineering Mathematics by N. P. Bali and Manish Goyal, Laxmi Publications
- A text book of Engineering Mathematics by Mathur, A.B., PHI Learning
- Numerical Methods by Balagurusamy, E, TMH
- Introductory Methods of Numerical Analysis by S. S. Sastry, PHI
- Business Statistics by T.R. Jain and S.C. Aggarwal, VK Global Publications Pvt. Ltd.

Useful Video Links:

Unit No.	Topics	Links
Unit I	Definition of Partial Differential Equations	https://www.youtube.com/watch?v=KlZqe4UC1jk
	Second-order linear partial differential equations	https://www.youtube.com/watch?v=PVUfuiuWaZQ
	Solution to homogenous and non-homogenous linear P.D.E	https://www.youtube.com/watch?v=5eZbgxmpK3Q&t=520s
	Separation of variables method	https://www.youtube.com/watch?v=DgvQzfLpaTY&t=92s
Unit II	Basic concept of Probability, Conditional probability, Bays' theorem	https://youtu.be/60vHy2lA4o4 https://www.youtube.com/watch?v=ZFMcWe_SNyI https://www.youtube.com/watch?v=-ELHOnLwE9U
	Discrete and Continuous Distributions	https://www.youtube.com/watch?v=ruWsWnik7YY
	Binomial, Poisson and Normal Distribution	https://www.youtube.com/watch?v=eH4bao6elis
	Measure of central tendency	https://www.youtube.com/watch?v=X48cZ6DGaSw
	Linear Regression and Correlation	https://www.youtube.com/watch?v=_WM8vzYSQhs
Unit III	Bisection method, Regula-Falsi method and Newton-Raphson method	https://www.youtube.com/watch?v=3j0c_FhOt5U&list=PLU6SqdYcYsfIk1VhXxIYNPFU67ym6gae8 https://www.youtube.com/watch?v=FliKUWUVrEI&list=PLU6SqdYcYsfIk1VhXxIYNPFU67ym6gae8&index=2 https://www.youtube.com/watch?v=7eHuQXMCOvA&list=PLU6SqdYcYsfIk1VhXxIYNPFU67ym6gae8&index=5
	Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae	https://www.youtube.com/watch?v=Y-yMQvYpltUhttps://www.youtube.com/watch?v=zdyUwzOm1zw https://www.youtube.com/watch?v=2h0R0Uka1HI
	Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules	https://www.youtube.com/watch?v=EA76ONWBgK4&list=PLhSp9OSVmeyJBkLSO51JFPSEIIoeRiaJy
Unit IV	Taylor's series	https://www.youtube.com/watch?v=0JxwRqIM5t8&t=879s
	Euler and modified Euler's methods	https://www.youtube.com/watch?v=zD-Mg4ZUGsE&t=776s https://www.youtube.com/watch?v=zD-Mg4ZUGsE
	Runge-Kutta method	https://www.youtube.com/watch?v=iSO9DFcMDog

Course Code	**PCC-ECE-209B**				
Category	Professional Core Courses				
Course Title	**Signal Systems & Network Analysis**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	4	
Course Objectives	The objectives of this course are • To provide knowledge of signals and systems in time and frequency domains. • To introduce Fourier and Laplace methods for signal analysis. • To explain electrical network analysis using standard techniques and parameters. • To study transient response, network functions, and topology analysis.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain and summarize various types of signals and systems by interpreting their properties and characteristics in time and frequency domains.
CO2	Apply Fourier Series and Fourier Transform techniques to determine signal spectra and evaluate system responses for different excitation signals.
CO3	Apply node, mesh and matrix analysis methods along with network theorems to determine responses of electrical networks.
CO4	Analyze electrical network behavior using network functions, pole–zero plots, two-port parameter relationships, state variable models and graph theory concepts.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Signal:** Signal definition and classification with examples; continuous/discrete-time, analog/digital, deterministic/random, even/odd, causal/non-causal, real/complex, periodic/a periodic, energy/power, and elementary discrete-time signals. . **Introduction to Systems:** Continuous –Time & Discrete Time System, classifications of Systems: Causal and Non-causal Systems, Time-variant and Time-invariant Systems, Stable and Unstable Systems, Linear and non-linear systems, Static and Dynamic System, Invertible and inverse Systems.

Unit-II	**Fourier Series (FS):** Definition, Frequency domain representation of a signal, Existence of Fourier Series, Types of Fourier Series, Fourier Spectrum, Dirichlet's Condition, Concept of Gibbs phenomenon, Properties of Fourier Series. **Fourier Transforms (FT):** Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT. **State Space Analysis:** State Variable Model, Variable Model using Physical variables, Variable Model using Phase variables.
Unit-III	**Fundamentals of Network Analysis:** Node and Mesh Analysis, matrix approach of network containing voltage and current sources. source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer theorem. **Network Functions:** Terminal pairs or Ports, Network functions for one-port and two portnetworks, poles and zeros of Network functions, Time domain behavior from the pole-zero plot.
Unit-IV	**Two port network and interconnections:** Characteristics and parameters of two port networks**,** Network Configurations**,** short-circuit Admittance parameters, open-circuit impedance parameters, Transmission parameters, hybrid parameters, Inter-relationships between parameters of two-port network sets, Inter-connection of two port networks. **Network Topology:**Basic terminology of network topology, Principles of network topology, graph matrices, network analysis using graph Theory.

Suggested Readings:

- Network Analysis by M.E. Van, Valkenburg.,, Pearson Education,3rd Edition
- Circuits and Network by Sudhakar A. Shyammohan, S. P., TMH
- Network Analysis and Synthesis by Raja, P; Singh, K.K, Raja, Umesh Publications
- Network Theory by Soni K.M., S.K. Kataria and Sons
- Network Theory and Filter Design by Aatre, Vasudev K, New Age International
- Signals & Systems by A. V. Oppenheim, A. S. Willsky, with S. Nawab, Pearson Education , 2nd Edition
- Signals & Systems by Nagrath & R. Ranjan, TMH
- Digital Signal Processing, Principles, Algorithms, & Applications by J. G. Proakis, D. G. Manolakis, Pearson Education,4th Edition
- Signals & Systems by Dr. Sanjay Sharma, Katsons Books
- Digital Signal Processing By S. Salivahanan
- Signals & Systems by A. Anand Kumar, PHI , 3RD Edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Basics of S&S	https://www.youtube.com/watch?v=PkFS5HutDiM&list=PLgwJf8NK-2e64X9h-rshDvVI76uD0gDOf&index=2
	LTI System	https://www.youtube.com/watch?v=EIYYhwTP1jk&list=PLBlnK6fEyqRhWw8GLfNIaWj7onqai8VjV
Unit-II	Fourier Transform	https://www.youtube.com/watch?v=rCw-FVegWJA&list=PLBlnK6fEyqRhkN2yGQpH40Pk-paIJzzvv
	Laplace Transform	https://www.youtube.com/watch?v=c9NibpoQjDk&t=9s
	State Variable technique	https://www.youtube.com/watch?v=DSvBXXnZv34&list=PLW6YlvHa65xg5asFyEm6hx0wjHNcaVpTT

Unit-III	Fundamentals of Network Analysis	https://www.youtube.com/watch?v=YhJWrhW3vjE&list=PL9RcWoqXmzaLG1SpJk_istSmesK4mZBiZ
Unit-IV	Two port network and interconnections	https://www.youtube.com/watch?v=pn777Ya0OHk&list=PLBlnK6fEyqRjQZj_QXvH8sp1lOWtjQCtT
	Transient Response of RC, RL, and RLC Circuits to various excitation signals	https://www.youtube.com/watch?v=Vb_OFPpynpg&list=PLgwJf8NK-2e58RyKZzw9t3mfXUqpJL6nV

Course Code	**HSMC-02B**
Category	Humanities and Social Science including Management Courses
Course Title	**Economics for Engineers**
Scheme and Credits	L T P **Credits** / 3 0 0 3 — **Semester-III**
Course Objectives	The objectives of this course are • To introduce the basic concepts of economics and their relevance to science, engineering, and national development. • To develop a foundational understanding of microeconomic principles such as demand, supply, production, cost, and market structures. • To equip students with tools to apply economic reasoning to real-world pricing, output, and market decisions. • To familiarize students with macroeconomic elements like the Indian economy, banking system, privatization, and globalization.
Assessment	30 Marks
End Semester Examination	45 Marks
Total	75 Marks
Duration of Exam	03 Hours

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Describe economic concepts, the connection between economics with engineering and technological development, along with economic laws relevant to resource based decision making in society.
CO2	Explain economic growth theories and illustrate the role of engineering and technology in supporting economic development.
CO3	Apply theories of consumption and production to the design and development of engineering products.
CO4	Analyze market conditions; evaluate cost structures and financial aspects to assess the feasibility of engineering projects.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Definition of Economics:** Various Definitions, Types of Economics, Micro and Macro Economics, Nature of Economic Problem, Production Possibility Curve, Economic Laws and their Nature, Relationship between Science, Engineering, Technology and Economic Development**.** **Demand:** Meaning of Demand, Law of Demand, Elasticity of Demand, Meaning, Factors affecting the Elasticity of Demand, Practical Application and Importance.
Unit-II	**Production:** Meaning of Production and Factors of production, Law of Variable Proportions, Returns to Scale, Internal and External Economies and Diseconomies of Scale, Various concepts of Cost of Production- Fixed Cost, Variable Cost, Money Cost, Real Cost, Accounting Cost, Marginal Cost, Opportunity Cost, Shape of Average Cost, Marginal Cost, Total Cost etc. in short run and long run.

Unit-III	**Market:** Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features). **Supply:** Supply and Law of Supply, Role of Demand and Supply in Price Determination and Effect of Changes in Demand and Supply on Prices.
Unit-IV	**Indian Economy:** Nature and Characteristics of Indian Economy as underdeveloped, developing and mixed economy (brief and elementary introduction). **Privatization:** Meaning, Merits and Demerits. **Globalization of the Indian Economy:** Merits and Demerits **Banking:** Concept of a Bank, Commercial Bank, Central Bank, Functions of a Bank, Difference between Commercial and Central Bank.

Suggested Readings:

- Modern Microeconomics: Theory and Applications by H.L. Ahuja, S. Chand & Company Pvt. Ltd.
- Indian Economy by S.K. Misra & V.K. Puri, Himalaya Publishing House
- Indian Economy : Principles and Policies by Srirangam, SriRam, ; Rohit Deo, Pearson Education
- Managerial Economics by R. Cauvery et al., S. Chand & Company Pvt. Ltd.
- Microeconomic Theory by Andreu; Whinston, Michael D ; Green, Jerry R, Oxford University Press.
- Principles of Economics by Case, Karl E; Fair, Ray C ; Oster, Sharon E, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Fundamental concepts of microeconomics, including definitions, types, and the nature of economic problems.	https://www.youtube.com/watch?v=IFtOcNbej0o&list=PLFNFJbo2hfBGRTCMuroZGykNzacwmAH2L
Unit-II	Production and Cost of production	https://www.youtube.com/watch?v=VU1zySe-8NA
Unit-III	Theory of Markets	https://www.youtube.com/watch?v=HylqSa58lqQ
Unit-IV	Nature and characteristics of the Indian economy, highlighting aspects of underdevelopment and development.	https://www.youtube.com/watch?v=ME-0GOhhZcs&list=PLFW6lRTa1g83winAoIK92HL4xTytJaW7S

Course Code	**LC-ECE-211B**				
Category	Professional Core Courses				
Course Title	**Electronic Devices Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are • To study the characteristics and applications of various electronic devices. • To analyze different transistor configurations and their behavior. • To explore the operation of field-effect transistors and their amplifier circuits. • To understand and test special semiconductor devices used in practical applications.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Examine the behavior of PN junction diodes under different biasing conditions and their applications in electronic circuits and filters.
CO2	Demonstrate the characteristics of special purpose semiconductor devices of thyristor family used in triggering and switching circuits.
CO3	Design and analyze transistor configurations in amplifiers and switches to optimize the performance of electronic circuits.
CO4	Demonstrate and analyze the characteristics of field-effect transistors under different configurations for electronic circuit applications.

List of Experiments

Sr.No.	Contents
1	To study and Analyze the characteristics of diode.
2	To study and Analyze zener diode as a voltage regulator.
3	To study and Analyze half wave and full wave rectifiers.
4	To study and Analyze power supply filters.
5	To study and Analyze diodes as a clipper and clamper.
6	To study and design of a DC voltage doubler.
7	To study and Analyze transistor as a constant current source in CE configuration
8	To study and Analyze CB & CC transistor configuration.
9	To study and Analyze CE amplifier for voltage, current and power gains input, output impedances.
10	To study characteristics of FET.
11	To study and Analyze FET common source amplifier.
12	To study characteristics of SCR.
13	To study characteristics of DIAC.
14	To study UJT as a relaxation oscillator.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Characteristics of diode.	https://www.youtube.com/shorts/wVVDrphYtLI
2	Clipper and Clamper Circuits	https://www.youtube.com/watch?v=JAWswYG-jDA
3	DC voltage doubler	https://www.youtube.com/watch?v=779NQxJZeFc
4	UJT as a relaxation oscillator	https://www.youtube.com/watch?v=8AK0rxgsN9o
5	CE amplifier	https://www.youtube.com/watch?v=0iRs1XMNChI
6	Transistor configuration.	https://www.youtube.com/watch?v=DJHmaOb6Z7s

Course Code	**LC-ECE-213B**				
Category	Professional Core Courses				
Course Title	**Signal Systems and Network Analysis Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are • To introduce circuit simulation tools for network analysis. • To analyze RLC circuits in time and frequency domains. • To design and study low-pass, high-pass, and band-pass filters. • To calculate and analyze two-port network parameters.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Demonstrate standard signals and visualize time-domain behaviors using circuit simulation tools.
CO2	Analyze RC, RL, and RLC circuits for transient and steady-state responses.
CO3	Design and examine the filter circuits by determining their frequency response characteristics.
CO4	Determine and verify two-port parameters and assess their effect on connected networks.

List of Experiments

Sr. No.	**Contents**
1	Introduction of circuit creation & simulation by relevant software.
2	To study various commands for creating two and three dimensional plots using simulation software.
3	Write a program to plot the continuous time and discrete time Step Function using simulation software.
4	Write a program to plot the continuous time and discrete time Impulse Function using simulation software.
5	Write a program to perform amplitude-scaling, time-scaling and time shifting on a given signal using simulation software.
6	Write a program to plot the continuous time and discrete Ramp Function using simulation software.
7	To plot the transient response of RC, RL circuit.
8	To find the resonance frequency, bandwidth of RLC series circuit.
9	To plot the frequency response of a low pass filter and determine half-power frequency.
10	To plot the frequency response of high pass filters and determines the half-power frequency.
11	To plot the frequency response of band-pass filters and determines the band-width.
12	To calculate and verify "Z" & "Y" parameters of a two port network.
13	To determine the equivalent parameter of parallel connections of two port networks and study loading effect.
14	To calculate and verify "ABCD" parameters of a two port network.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond the syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Introduction of circuit creation & simulation software like TINAPRO	https://www.youtube.com/watch?v=REQ9K3qqp-0&list=PLsMtCcso-QfbYqJOsWwcg97gtN0GxungD
2	Analyze the transient response of RC, RL, and RLC circuits using simulation tools to evaluate circuit behavior and performance.	https://www.youtube.com/watch?v=86OpfpZchOY
3	To calculate and verify "Z" & "Y" parameters of a two port network.	https://www.youtube.com/watch?v=Op__l8_kMes
4	To plot the frequency responses of a high pass filter and determine the half-power frequency.	https://www.youtube.com/watch?v=lagfhNjMuQM
5	To calculate and verify "ABCD" parameters of a two port network.	https://www.youtube.com/watch?v=5Q1coA-0-Tg
6	To plot the frequency response of a band-pass filter and determine the band-width.	https://www.youtube.com/watch?v=MG_OvKdhqiQ
7	Introduction to MATLAB	https://www.youtube.com/watch?v=0x4JhS1YpzI&list=PLjVLYmrlmjGcNZrPa9bRg0JVlcxLX4Mu9
8	Amplitude-scaling, Time-scaling and Time shifting on a given signal.	https://www.youtube.com/watch?v=IO3K7UpKcgY

Course Code	**LC-ECE-215B**				
Category	Professional Core Courses				
Course Title	**Electronic Workshop & PCB Design Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand and simulate electronic circuits using software tools. ● To learn the operation of PCB fabrication machines. ● To practice PCB fabrication processes and techniques. ● To design, assemble, and test printed circuit boards				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Understand and apply simulation and PCB design tools for the design and development of electronic circuits.
CO2	Implement the process of etching, UV exposure, drilling and coating for PCB fabrication using standard tools and techniques.
CO3	Analyze circuit parameters and component behavior to design compact and efficient PCBs for optimized system performance.
CO4	Evaluate the functionality and performance of fabricated electronic circuits through testing and validation procedures.

List of Experiments

Sr. No.	Contents
1	Introduction & Hands on experience to use circuit creation & simulation software like TINAPRO, Edwin XP etc.
2	Identification of various active and passive devices used for circuit designing. such as R, C, L, transformers, relays, switches, bread board, universal printed circuit board, diode, Zener diode, light emitting diode, transistors etc.
3	To study the process of PCB fabrication and assembly, including etching, post-etching treatments and various component mounting techniques.
4	Design and verify half wave rectifier with software like TINAPRO/EdwinXP.
5	Design and verify full wave rectifier with software like TINAPRO/EdwinXP.
6	Design and verify half adder with software like TINAPRO/EdwinXP.
7	Design and verify full adder with software like TINAPRO/EdwinXP.
8	Convert the power supply circuit into PCB & simulates its 2D & 3D view.
9	To test the functionality and performance of the electronic circuit.
10	Design and simulate a regulated power supply circuit using LM317/7805 IC and convert it into a PCB layout.
11	Fabricate a simple electronic project on a PCB and test its functionality.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond the syllabus.

Useful Video Links:

Exp No.	Topics	Links
1	TINA- Introduction and DC Simulation	https://youtu.be/51ztp8zgEG8
2	Etching of PCB	https://youtu.be/QbAuq00BalI
3	Exposing to UV Light & Developing	https://youtu.be/ILRdnfEM7YI
4	Power supply circuit using LM317/7805 IC and convert it into a PCB layout.	https://www.youtube.com/watch?v=d-j0onzzuNQ

Course Code	***MC-201B**				
Category	Mandatory Courses				
Course Title	**Environmental Science**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	2	0	0	-	
Course Objectives	The objectives of this course are • Create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources. • Develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health. • Foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society. • Engage students in practical learning through fieldwork and case studies to apply environmental concepts for sustainable development and responsible citizenship.				
Assessment	20 Marks				
End Semester Examination	30 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				
Remarks	The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Describe key concepts of environmental studies, types of natural resources, ecosystem structures, pollution types, major environmental laws and human-environment interactions.
CO2	Explain the interrelationships among ecosystems, biodiversity, pollution, social issues, environmental ethics and related legislation for sustainable development.
CO3	Apply principles of environmental management, pollution control, disaster preparedness and sustainable practices in real-world and field-based environmental contexts.
CO4	Analyze environmental problems, population growth impacts, climate change, welfare programs and the role of information technology in promoting public health and environmental sustainability.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts (covering all units) of 1.5 marks each and remaining eight questions of 6 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	The Multidisciplinary nature of environmental studies. Definition scope and importance. **Natural Resources:** Renewable and non-renewable resources, Natural resources and associated problems. **a) Forest resources:** Use and over-exploitation: deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people. **b) Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. **c) Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies. **d) Food resources:** World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer pesticide problems, Water logging, salinity, case studies. **e)** Energy resources: Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies. f) **Land resources:** Land as are source, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, equitable use of resources for sustainable life styles
Unit-II	**Ecosystems**: Producers, Consumers and Decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, Food web sand ecological pyramids**,** Introduction, types, characteristic features, structure and function of Forest ecosystem, Grass land ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). **Biodiversity and its conservation:** Introduction, Definition, Genetic, Species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wild life, man-wild life conflicts, Endangered and endemic species of India, In-situ and ex-situ conservation of biodiversity.
Unit-III	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards. **Solids Waste Management:** Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies. **Disaster Management:** Floods, Earthquake, Cyclone and Landslides. **Social issues and the Environment:** From unsustainable to sustainable development, Urban problems related to energy, Water conservation, Rain Water Harvesting, Watershed Management, Resettlement and Rehabilitation of People, its problems and concerns case studies. **Environmental Ethics:** Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Waste land reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wild life Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Unit-IV	**Human population and the Environment:** Population growth, Variation among Nations, Population explosion-Family Welfare Programme, Environment and human health, Human Rights. Value Education, HIV/AIDS, Woman and Child Welfare Role of Information Technology in Environment and human health. Case Studies. **Field Work (Field work equal to 10 lecture hours)-**Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain, Visit to a local polluted site-urban/Rural/Industrial/ Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hills, slopes, etc.

Suggested Readings:

- Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner
- The Biodiversity of India by Bharucha, MA Pin Publishing Pvt. Ltd., Ahmedabad.
- Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc., 1989
- Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
- Global Biodiversity Assessment by V.H. Heywood & R.T. Watson, Cambridge University Press, 1995, 1140p.
- Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House, Delhi, 1995, 284p.
- Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
- Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd., 1987, 345p.
- Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut, 2001.
- Survey of the Environment, The Hindu.
- Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
- Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
- Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA, 1998, 499p.
- A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
Unit-II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
Unit-III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

Course Code	**PCC-ECE-202B**				
Category	Professional Core Courses				
Course Title	**Analog and Digital Communication**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the basic concepts of communication systems and the impact of noise on signals. • To study various techniques used for signal transmission and reception. • To learn methods for converting signals between analog and digital forms. • To understand the working principles of radio transmitters and receivers.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define basic terminologies, signal types, communication modes and media used in analog and digital systems.
CO2	Understand and apply analog & pulse modulation and demodulation techniques used in communication systems for effective signal transmission.
CO3	Describe the structure and function of various radio transmitters and receivers used in communication systems.
CO4	Classify various modulation techniques and examine the impact of noise on signal quality and system performance

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction :** Modulation, Demodulation, Radio Frequency Spectrum, Signals & their classification, Limitations & Advantages of a Communication System, Comparison of Analog & Digital Communication Systems, Historical Perspective, Modes & Medias of Communication. **Noise:** Sources of Noise, External & Internal Noise, Noise Ratio, Noise Figure, Noise Temperature, Noise in Communication Systems, Pre-Emphasis & De-Emphasis.
Unit-II	**Amplitude Modulation:** Basic definition & derivation for Modulation & Modulation Index, Modulation & Demodulation of AM, Suppressed Carrier Modulation: - SSB-SC, DSB-SC, VSB Modulation & Demodulation, Comparison of various AM Systems, Generation and Detection (Demodulation) of AM Waves. Quadrature Amplitude Modulation. **Angle Modulation:** Basic definition & derivation for Modulation & Modulation Index, Generation of FM & PM waves, Bandwidth & Frequency Spectrum of FM, Types of FM, Demodulation of FM & PM waves, Comparison between AM, FM & PM.

Unit-III	**Pulse Analog Modulation:** Sampling theory, Multiplexing & Demultiplexing (TDM, FDM), Sampling Techniques, PAM, PWM, PPM, Modulation & Demodulation techniques. **Pulse Digital Modulation:** Quantization, Elements of Pulse Code Modulation, Noise, Bandwidth & Channel Capacity of PCM System. Delta Modulation (DM), Adaptive Delta Modulation (ADM), Differential Pulse Code Modulation (DPCM). Comparison of PCM/DM/ADM/DPCM.
Unit-IV	**Digital Carrier Modulation and Demodulation Techniques:** coherent and non-coherent modulation and demodulation techniques including ASK, FSK, PSK, QPSK, MSK, and DPSK; M-ary modulation schemes including M-PSK, M-FSK, and M-QAM. Performance comparison of digital modulation techniques (ASK, FSK, PSK). **Transmitters & Receivers**: Basic Block Diagram of Radio Transmitte r, Classification of Radio Transmitters, Basic Block Diagram of Radio Receiver, Classification of Radio Receivers.

Suggested Readings:

- Electronic Communication Systems, By Kennedy – TMH
- Communication Systems, By Singh & Sapre – TMH
- Communication System (Analog & Digital), Sanjay Sharma, Kataria & sons.
- Digital and Analog Communication Systems by Couch, Leon W, Pearson Education
- Communication System, By Manoj Duhan – I. K. International
- Analog Communication Systems by Chakraborty P, Dhanpat Rai & Company
- Communication System by Haykin, Simon, Wiley India

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Communication System	https://www.youtube.com/watch?v=INn5EQ9l5PE
	Noise in communication system	https://www.youtube.com/watch?v=u9nuKs2RAe0
Unit-II	Analog Modulation & Demodulation	https://www.youtube.com/watch?v=kAs8OerKRmc&list=PLgwJf8NK-2e7uyUYrpgUUQowmRuKxRdwp
Unit-III	Pulse Analog & Digital Modulation	https://youtu.be/TM47sEXeaj8?list=PLDp9Jik5WjRvjqQ6ruRFC6hZcxnOsp3BE
Unit-IV	Digital Carrier Modulation and Demodulation Techniques	https://www.youtube.com/watch?v=01zv0thaAUw
	Radio Transmitters & Receivers	https://www.youtube.com/watch?v=iUBC-S_zLk4

Course Code	**PCC-ECE-204B**				
Category	Professional Core Courses				
Course Title	**Analog Electronic Circuits**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To study working operation and behavior of transistors and amplifiers. • To understand different types of feedback which affects the overall performance of the circuit? • To learn working operation of oscillator circuits. • To study power amplifiers, voltage regulators, and the basics of operational amplifiers with practical circuit applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Analyze the frequency response of BJTs and multistage amplifiers to determine gain, bandwidth, and high-frequency performance.
CO2	Design and implement feedback mechanism in amplifiers and oscillators used for improving the performance of analog circuits.
CO3	Classify power amplifiers and voltage regulators to ensure efficient power management in analog and mixed-signal circuits.
CO4	Understand and apply the process, principles and characteristics of operational amplifiers and IC fabrication for designing the electronic circuits.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Multistage Amplifier:** Classifications of amplifiers, Multistage amplifier voltage gain,RC Coupled Transistor Amplifier, Frequency response of RC Coupled Transistor Amplifier, Lower & Upper Cut off Frequency response, Transformer Coupled Amplifier, Direct Coupled Amplifier, Cascode Amplifier, Darlington Pair Amplifier, Distortion In Amplifiers. **Feedback Amplifiers:** Feedback concept, Transfer Gain with Feedback, General Characteristics of Negative Feedback, Effects of Negative Feedback on gain, Transfer gain, Input and Output Resistance calculation of feedback amplifiers/topologies: Voltage Series Feedback topology, Voltage Shunt, Current Series & Current Shunt topology.

Unit-II	**Oscillators:** Barkhausen Criterion, Condition for Sustained Oscillations & Frequency of Oscillations, Oscillator with RC Feedback circuit (RC Phase Shift, Wien Bridge), Tuned Collector Oscillator, LC Feedback circuits (Hartley, Colpitts) oscillators, Crystal Oscillator. **Power Amplifier:** Definition, Application & Types of Power Amplifiers, Class - A, B, AB, C, D power amplifier, Push Pull Amplifiers, Distortion in Simple & Push Pull Amplifier, Complementary Push Pull Amplifier and Integrated Circuit Power Amplifier.
Unit-III	**Voltage Regulators:** Voltage Regulation, Basic Series Regulators, Basic Shunt Regulators, Power Supply Parameters, Basic Switching Regulators, Step up Configuration, Step down Configuration, IC Voltage Regulator, SMPS. **Integrated Circuit Fabrication Process**: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapour deposition, sputtering, twin-tub CMOS process.
Unit-IV	**Operational Amplifier Fundamentals:** Block Diagram Representation, Ideal Op-Amp, OP-AMP Equivalent Circuit, Ideal Voltage Transfer Curve, Input Offset Voltage, Input Bias Current, Input Offset Current, Output Offset Voltage, Thermal Drift, Common Mode Configuration and CMRR,Slew Rate, Frequency Response of Op-Amp, Open loop and closed loop Configurations of an Op-Amp, Op-Amp as summing, scaling and averaging amplifier, Integrator, Differentiator. **Operational Amplifier Applications**: Linear and non-linear applications-ADC and DAC, Multivibrators, Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, 555 Timer, Monostable & Astable Operation with 555 Timer.

Suggested Readings:

- Integrated Electronics By Millman Halkias -- TMH.
- Electronics Device & Circuit By Robert Boylestad ,Louis Nashelsky, 11th Edition, Pearson Education.
- Electronics Device & Circuit Theory By Nagrath, I.J., PHI Learning
- Electronics Device & Integrated Circuit By Singh, A K, PHI Learning
- A Textbook of Electronic Devices and Circuits by Gupta, J.B., S.K. Kataria and Sons
- Integrated Electronics : Analog and Digital Circuits and Systems by Millman, Jacob, TMH
- Applications and Design with analog Integrated Circuits by Jacob, Michael, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	RC Coupled Amplifiers	https://youtu.be/BSR26SU3R2U
Unit-II	Power Amplifiers	https://youtu.be/huDZjQcEBMg
Unit-III	Voltage regulators	https://youtu.be/R_QnIAEk7Go
Unit-IV	Operational Amplifier	https://youtu.be/clTA0pONnMs

Course Code	**PCC-ECE-206B**				
Category	Professional Core Courses				
Course Title	**Digital Electronics**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	1	0	4	
Course Objectives	The objectives of this course are ● To learn fundamentals of digital logic and Boolean algebra. ● To design combinational and sequential logic circuits. ● To understand ADC/DAC and memory devices. ● To study programmable logic devices like FPGA and CPLD.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Understand the knowledge of Boolean algebra, K-MAP and other digital design methods for simplification and optimization of digital circuits.
CO2	Design and implement combinational logic circuits using logic gates for arithmetic operations, code conversion, and control applications.
CO3	Understand and apply the concepts of latches, flip-flops, and counters in designing synchronous and asynchronous circuits for memory and storage applications.
CO4	Analyze memory types and programmable logic device architectures to interpret the functional organization.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Logic Simplification**: Review of Boolean Algebra and De Morgan's Theorem, Digital codes, Logic gates and their operations, Realization of logic gates using universal gates, Number system, Representation of Boolean functions in sum of products (SOP) form and product of sums (POS), Addition and subtractions of a complements numbers, Minimization of Boolean functions using Karnaugh map and Quine McCuskeymethods, Error detection and correction techniques using Parity Check method and Hamming Code
Unit-II	**Combinational Logic Design**: Half and Full Adders, Half and Full Subtractors, Multiplexers, Demultiplexers, Encoder, Decoder, Magnitude Comparators, Priority encoder, Parallel Adders, Adder with Look Ahead Carry, BCD Adder.

Unit-III	**Sequential Logic Design**: Latches, Concept of edge triggered and level triggered clock, S-R, JK and Master-Slave JK FF, D FF, T FF,Conversions of FF, Ripple and Synchronous counters, Ring and Johnson counter, UP & DOWN counter, Sequence Generator, Shift registers.
Unit-IV	**A/D and D/A Converter**: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel - comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs. **Programmable Logic Devices**: ROM, PLA, PAL, SRAM, DRAM. FPGA and CPLDs

Suggested Readings:

- Modern digital Electronics by R.P. Jain, Tata McGraw Hill, 4th edition.
- Switching Theory & Logic Design by A.Anand Kumar, PHI.
- Digital Electronics Circuit and System by V K Puri, TMH.
- Digital Circuits and Systems by D.V. Hall, Tata McGraw Hill.
- Principle of Digital Electronics by K Meena, PHI
- Logic & Computer Fundamentals by Morris Mano, Pearson Education, 4th Edition.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Boolean Algebra	https://www.youtube.com/shorts/xtAYbY_Pz7I
Unit-II	Multiplexer	https://www.youtube.com/watch?v=p6yPvw88BJk
	Combinational Circuits	https://www.youtube.com/watch?v=fXrbYMDevDU
Unit-III	Sequential Circuits	https://www.youtube.com/watch?v=S0mKCNLmCh4&list=PLgwJf8NK-2e4mEQv0ttgW-am4wiqrpdcX
	Counter	https://www.youtube.com/watch?v=NTCrCYPoA5A&list=PLgwJf8NK-2e6lcDg0NxW-_yO6Bl5dPBp8
Unit-IV	Finite state machines	https://www.youtube.com/watch?v=LOZxYBOKRLg
	PLD's	https://www.youtube.com/watch?v=m6975d-U6j8

Course Code	**PCC-ECE-208B**				
Category	Professional Core Courses				
Course Title	**Microprocessor and Microcontroller**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand the architecture and instruction set of microprocessors (8086, x86) and microcontrollers (8051, ARM). ● To develop low-level programming skills using assembly language. ● To learn peripheral interfacing concepts such as timers, I/O ports, ADC/DAC, and communication protocols. ● To explore advanced processors and embedded system using ARM Architecture.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Describe the features and architecture of Intel processors and microcontrollers for signal descriptions and system design.
CO2	Use addressing modes and instructions of microprocessors and microcontrollers to write simple and efficient assembly programs.
CO3	Classify the interrupts and modes of operation in microprocessors and microcontrollers and analyze their impact on system performance and functionality.
CO4	Apply appropriate data transfer schemes and hardware for transfer data between the of peripheral devices for interfacing I/O devices.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fundamentals of Microprocessors and Programming:** Introduction to Microprocessors: Evolution, 8-bit/16-bit (8085/8086), Architecture, Pin configuration, Addressing modes and register organization of 8085. **8086 Architecture**: Pin configuration, Register organization, Addressing Modes, Memory Segmentation, Instruction Set of 8086, Minimum/Maximum Mode, Assembly language programming of 8086.

Unit-II	**Microprocessor Interfacing** Overview of Intel Pentium family processor, Overview of Multi-core Processors and Mobile Processor, Memory Interfacing, Peripheral Interfacing (8255 PPI, 8254 Timer, 8237 DMA, 8259 PIC), Concepts of Interrupts and DMA. **Memory Concepts**: Cache Memory, Virtual Memory – Mapping and Access Mechanisms.
Unit-III	**8051 Microcontroller and Interfacing:8051 Architecture**: RAM/ROM layout, machine cycle, I/O structure, Instruction Set: Addressing Modes, Data Transfer, Arithmetic, Logical, Branching, Assembly Language Programming. Peripherals and Interfacing: Timers/Counters, Serial Communication, Interrupts, ADC, DAC, LCD, LED, Keypad.
Unit-IV	**ARM Processor Architecture and Instruction set :**RISC vs. CISC, ARM Design Philosophy, ARM Architecture: States (ARM, Thumb, Jazelle), Register, Sets, Modes, Pipelining ARM Instruction Set: Data Processing, Load/Store, Branch, Conditional Execution, SWI, Vector Tables, Exception Handling.

Suggested Readings:

- Microprocessors and interfacing by D. V. Hall,, TMH, 2nd Edition.
- Microprocessor 8086: Architecture, Programming and Interfacing by Sunil Mathur, PHI Publisher
- Microprocessors and Microcontrollers by Sunil Mathur, Jeebananda Panda, PHI Publisher
- Advanced Microprocessors and Peripherals Architectures, Programming and Interfacing by Ray A. K. and Burchandi, TMH.
- The Intel Microprocessors 8086- Pentium Processor by Brey, 8th Edition, Pearson Education.
- The X86 PC: Assembly Language, Design and interfacing by M. A. Mazidi, J. P. Maizidi and Danny Causey, 5th Edition, Pearson Education.
- Microcontrollers: Architectures, Programming, Interfacing and System Design by Raj Kamal, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Microprocessors and Interfacing – NPTEL Focuses on the interfacing aspects of microprocessors, covering essential concepts and practical applications	https://www.youtube.com/playlist?list=PLdlPA9pGVVtaUwRP-2Eaux10vo_USuDy1
	Microprocessors & Microcontrollers by Prof. Sunil Mathur	https://www.youtube.com/@profsunilmathur8809
Unit-II	Advanced Microprocessors and Memory Systems	https://www.youtube.com/playlist?list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3
Unit-III	8051 Microcontroller and Interfacing ,The 8051 Microcontroller and Embedded Systems by Prof. Santanu Chattopadhyay (IIT Kharagpur)	https://www.youtube.com/playlist?list=PLEPI1RnS5drMCNu1VPDwdrRO_U0awwTxJ
Unit-IV	ARM Processor Architecture and Embedded Design, Embedded System Design with ARM by Prof. Dhananjay V. Gadre (IIT Delhi). Focuses on ARM architecture and its application in embedded system design, offering practical insights and examples.	https://www.youtube.com/playlist?list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU

Course Code	**PEC-ECE-210B**				
Category	Professional Elective Courses				
Course Title	**Scientific Computing**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand different types of errors in numerical computation. • To understand advanced computational techniques. • To solve linear and nonlinear systems, and perform data fitting.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define errors, stability, conditioning and other key terminologies related to computer arithmetic and numerical methods.
CO2	Describe the purpose, strengths, and application areas of numerical methods used in solving engineering and scientific problems.
CO3	Apply methods to solve linear and nonlinear systems, data fitting, interpolation, differentiation, integration, and differential equations.
CO4	Analyze the performance, accuracy, and limitations of numerical algorithms and their applications in simulation, optimization, and signal processing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction:** Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation.
Unit-II	**System of linear equations:** Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting **Eigen values and singular values:** Eigen values and Eigenvectors, Methods for Computing All Eigen values, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit-III	**Nonlinear equations:** Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation
Unit-IV	Initial Value Problems for ODES, Euler's Method, Taylor Series Method, RungaKutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigen value Problems Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

Suggested Readings:

- Scientific Computing: An Introductory Survey by Heath Michael T., McGrawHill, latest edition.
- Numerical Recipes: The Art of Scientific Computing by Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, Cambridge University Press, latest edition
- Introduction To Computational Mathematics by Xin-she Yang (Ed.).,World Scientific Publishing Co.
- Computational Science by Kiryanov D. and Kiryanova E., Infinity Science Press, latest edition
- Scientific Computing With MATLAB And Octave by Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, Springer, latest edition.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Data Error and Computational, Truncation Error and Rounding Error	https://www.youtube.com/watch?v=nPZmfpFrgPo
Unit-II	Positive Definite Systems and Indefinite System	https://www.youtube.com/watch?v=ttMZB5Gm_fM
Unit-III	One-Dimensional Optimization, Multidimensional Unconstrained Optimization	https://www.youtube.com/?bp=wgUCEAE%3D
Unit-IV	Solution for Sparse Linear Systems	https://www.youtube.com/watch?v=gwqbNtFuvWU

Course Code	**PEC-ECE-212B**				
Category	Professional Elective Courses				
Course Title	**Power Electronics**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the construction and working of power electronic devices. • To design and analyze rectifiers, inverters, choppers, and converters. • To study different control techniques for AC and DC electric drives. • To explore real-world applications of power electronics in systems like UPS and electric vehicles.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the construction, working principles, and characteristics of power electronic devices.
CO2	Analyze single-phase and three-phase controlled rectifier circuits and inverter configurations for various load conditions.
CO3	Apply the concepts of choppers, dual converters, and cyclo- for efficient power control and conversion in electrical systems.
CO4	Implement thyristor-based control strategies for DC and AC electric drives and identify real- world applications of power.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Role of power electronics, SCR- Construction, working principles of SCR, V-I characteristics of SCR, Two transistor analogy of SCR, Protection of SCR, Different methods of SCR triggering, Different commutation circuits for SCR, Construction, working principle & V-I characteristics of DIAC, TRIAC, IGBT, GTO, MOSFET, UJT. Basic idea about the selection of Heat sink for thyristors.
Unit-II	**Controlled Rectifiers:** Single phase half wave-controlled rectifier with R, R-L Load & concept of freewheeling diode, Single phase half controlled full wave rectifier with R, R-L Load), Single phase fully controlled full wave rectifier (centre tapped and bridge), Three phase full wave half-controlled and fully controlled bridge rectifier (R Load)
Unit-III	**Inverters:** Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel, inverters & their applications. **Choppers:** Introduction, types of choppers (Class A, Class B, Class C, Class D and Class E). Step up and step-down choppers. Comparison of various choppers.

Unit-IV	**Dual Converters and cyclo-converters:** Introduction, types & basic working principle of dual converters and cyclo- converters & their applications. **Thyristorised Control of Electric Drives:** DC drive control (half-wave, full-wave, and chopper-fed drives), AC drive control (phase control, V/f control, inverter/cycloconverter drives, and slip control) applications of power electronic devices. UJT as relaxation oscillator.

Suggested Readings:

- Power electronics by Muhammad H. Rashid, Prentice Hall of India.
- Power electronics by PC Sen,2nd edition, TMH.
- Power Electronics: Devices, Circuits, and Matlab Simulation by Alok Jain, Pernam international Publication.
- Power Electronics by M H Rashid, 3rd Edition,Pearson Education.
- Power Electronics and drive by Sachin Sharma, Vayu Education.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Two transistor analogy of SCR	https://www.youtube.com/watch?v=uN42NhZCU_M
Unit-II	Single phase half controlled full wave rectifier	https://www.youtube.com/watch?v=lFrbdl9AsQE
Unit-III	Step up and step-down choppers	https://www.youtube.com/watch?v=8UbLt2U1Ydw
Unit-IV	Thyristorised Control of Electric drives DC drive control	https://www.youtube.com/watch?v=q4YEChr8R5I

Course Code	**PEC-ECE-214B**				
Category	Professional Elective Courses				
Course Title	**Introduction to Artificial Intelligence**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand the fundamentals of artificial intelligence. • To study AI search and problem-solving techniques. • To learn knowledge representation and logical reasoning methods. • To explore planning and probabilistic reasoning in AI systems.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
CO2	Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
CO3	Analyze Supervised Learning Vs. Learning Decision Trees.
CO4	Design and Implement the applications of Probabilistic Reasoning and Bayesian Networks.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to AI** - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.
Unit-II	**Games** - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.
Unit-III	**First-Order Logic** - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

Unit-IV	**Planning** - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning. Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions.

Suggested Readings:

- Introduction to Artificial Intelligence by Rajendra Akerkar, PHI Publications.
- Artificial Intelligence: A modern approach by Stuart Russell & Peter Norvig, Pearson Publications Fourth Edition.
- Modern Microeconomics: Theory and Applications by H.L. Ahuja, S. Chand & Company Pvt. Ltd.
- Introduction to Artificial Intelligence and Machine Learning by Dr. Swapna, Dr, Bharat Kumar GJ, Dr. Bhoomeshwar Bala, Walnut publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Artificial Intelligence	https://www.youtube.com/watch?v=uB3i-qV6VdM&list=PLxCzCOWd7aiHGhOHV-nwb0HR5US5GFKFI
Unit-II	Constraint Satisfaction Problem (CSP) in AI with Example Constraint Satisfaction Algorithm Works	https://www.youtube.com/watch?v=AgyCSmDVk5s https://www.youtube.com/watch?v=udOfKqeLVSg
Unit-III	First order/Predicate logic | Artificial Intelligence Negation of Quantifiers | Predicate Logic	https://www.youtube.com/watch?v=Aw3EOSr64j0 https://www.youtube.com/watch?v=XYfTz5gziBk
Unit-IV	Planning Introduction - Artificial Intelligence Planning Graph in Artificial Intelligence	https://www.youtube.com/watch?v=TK7ORfbT5UI&list=PLAHr0cis_HGUOO9lSd4dTJ-37qCFtlBgh https://www.youtube.com/watch?v=JGrU9Bcf4wA&list=PLAHr0cis_HGUOO9lSd4dTJ-37qCFtlBgh&index=7

Course Code	**PEC-ECE-216B**				
Category	Professional Elective Courses				
Course Title	**Introduction To MEMS**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • The objectives of this course are • To introduce fundamentals of MEMS, microsystems, scaling, and their applications. • To provide knowledge of MEMS fabrication and micromachining techniques. Applications. • To Develop understanding of mechanical behaviour in MEMS structure. • To Familiarize with modeling and analysis of MEMS devices.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define MEMS concepts, scaling principles and applications of micro/nano sensors and actuators.
CO2	Explain MEMS fabrication and micromachining techniques for development of microsystems.
CO3	Apply fundamental stress, strain, and energy principles to analyze the mechanical behavior of MEMS structures.
CO4	Analyze MEMS devices using finite element and coupled electromechanical approaches.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Overview of MEMS and Microsystems: Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries.
Unit-II	Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.
Unit-III	Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hooke's law, Poisson effect, Linear, Thermal Expansion, Bending; Energy methods. Introduction to Scaling, Scaling in Geometry, Rigid Body dynamics, Electrostatic forces, Electromagnetic forces, Electricity, Fluid Mechanics, Heat Transfer.
Unit-IV	Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems: Electrostatics, Coupled electro mechanics.

Suggested Readings:

- Microsystem Design by Stephen D.Senturia, Kluwer academic publisher,2001.
- Micro-Electromechanical systems by S. E.Lyshevski .
- Fundamentals of Nano-and Microengineering by M. Madou, CRC press, 2005.
- Fundamentals of Microfabrication by M. Madou, CRC Press, 1997.
- Micromachined Transducers Sourcebook by G. Kovacs, McGraw-Hill, Boston, 1998.
- Micromechanical Transducers by M.H. Bao , New York, 2000.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to MEMS & Microsystems MEMS Introduction and Applications	https://www.youtube.com/watch?v=j9y0gfN9WMg onlinecourses.nptel.ac.in
Unit-II	MEMS Fabrication	https://onlinecourses.nptel.ac.in/noc19_ee40/preview
Unit-III	Mechanics of Solids	https://nptel.ac.in/courses/105104160
Unit-IV	A brief Introduction of Micro-Sensors	http://digimat.in/nptel/courses/video/108106165/108106165.html

Course Code	**HSMC-01B**				
Category	Humanities and Social Sciences including Management Courses				
Course Title	**Fundamental of Management and Organizational Behavior**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To introduce students to foundational management theories, functions, and organizational concepts to build a strong conceptual framework. • To develop understanding of individual and group behavior, motivation, communication, and leadership in organizational settings. • To equip students with practical skills to manage interpersonal processes, conflicts, and team dynamics effectively. • To foster critical analysis of organizational structures, cultures, and change mechanisms to enhance adaptability and effectiveness in organizations.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define fundamental management concepts, functions, organizational processes, and organizational behavior elements.
CO2	Explain the roles, skills, and interrelationships in management, individual behaviors, group dynamics, and communication processes within organizations.
CO3	Apply principles of management, motivation techniques, leadership styles, and conflict management strategies to solve organizational behavior challenges.
CO4	Analyze organizational structure, culture, change processes, and behavioral dynamics to support effective decision-making and organizational development.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (covering all units) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction of Management:** Meaning, Definitions, Nature of Management; Managerial Levels, Skills and Roles in an Organization. **Functions of Management:** Planning, Organizing, Staffing, Directing & Controlling, Interrelationship of Managerial Functions, Scope of Management, Importance of Management, Difference between Management and Administration.

Unit-II	**Introduction of Organization:** Meaning and Process of Organization, Management v/s Organization. **Fundamentals of Organizational Behavior:** Concepts, Evolution, Importance and Relationship with other Fields, Contemporary Challenges and Opportunities of OB **Individual Processes and Behavior:** Personality, Concept, Determinants and Applications. **Perception:** Concept, Process and Applications. **Learning:** Brief Introduction. **Motivation:** Concept, Techniques and Importance.
Unit-III	**Interpersonal Processes:** Teams and Groups, Definition of Group, Stages of Group Development, Types of Groups, Meaning of Team, Merits and Demerits of Team, Difference between Team and Group, Conflict- Concept, Sources, Types, Management of Conflict. **Leadership:** Concept, Function, Styles, Qualities of Leadership. **Communication:** Meaning, Process, Channels of Communication, Importance and Barriers of Communication.
Unit-IV	**Organizational Processes:** Organizational Structure, Meaning and Types of Organizational Structure and their effect on Human Behavior. **Organizational Culture:** Elements, Types and Factors affecting Organizational Culture. **Organizational Change:** Concept, Types and Factors affecting Organizational Change, Resistance to Change.

Suggested Readings:

- Fundamentals of Management by Robbins, S.P. and Decenzo, Pearson Education, New Delhi.
- Organisational Behaviour by Robbins, S.P. & Judge, T.A., Prentice Hall of India, New Delhi.
- Management concept practice and cases by Ghuman Karminder, AswathappaK.,TM, New Delhi.
- Fundamental of Management by Chhabra T. N., Sun India Publications, New Delhi.
- Organizational Behaviour by Stephen P Robin, Pearson Education.
- Organizational Behaviour by McShane, Steven L, Tata McGraw Hill, New Delhi.
- Organizational Behaviour by FC Sharma, Shree mahavir publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Nature and Scope of Management	https://nptel.ac.in/courses/110105146
Unit-II	Perception and Personality	https://nptel.ac.in/courses/110103433
Unit-III	Group Dynamics	https://archive.nptel.ac.in/courses/110/106/110106145/
Unit-IV	Organizational Change, Resistance to Change.	https://nptel.ac.in/courses/110105146

Course Code	**LC-ECE-218B**				
Category	Professional Core Courses				
Course Title	**Analog & Digital Communication Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To understand the basic principles of analog modulation and demodulation techniques like AM, FM, and PM. • To learn and observe the waveform analysis of pulse modulation and demodulation methods. • To study digital modulation techniques such as ASK, FSK, and PSK with waveform analysis.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Apply various analog modulation schemes for representation of AM, FM, PM signals.
CO2	Implement various analog detection methods for optimized & effective signal reception.
CO3	Examine the performance and applications of various pulse modulation & demodulation techniques used in communication systems.
CO4	Categorize different digital modulation & demodulation schemes used in modern communication systems.

List of Experiments

Sr. No.	Contents
1	To study and waveform analysis of amplitude modulation and determine the modulation index of amplitude modulation.
2	To study and waveform analysis of amplitude demodulation by any method.
3	To study and waveform analysis of frequency modulation and determine the modulation index of frequency modulation.
4	To study and waveform analysis of frequency demodulation by any method.
5	To study and waveform analysis of phase modulation.
6	To study Phase demodulation.
7	To study Pulse amplitude modulation and demodulation.
8	To study Pulse width modulation and demodulation.
9	To study Pulse position modulation and demodulation.
10	To study Pulse code modulation.
11	To study delta modulation.
12	To study Amplitude Shift Keying (ASK) modulation.
13	To study Frequency Shift Keying (FSK) modulation.
14	To study Phase Shift Keying (PSK) modulation.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Analog Modulation & Demodulation	https://www.youtube.com/watch?v=kAs8OerKRmc&list=PLgwJf8NK-2e7uyUYrpgUUQowmRuKxRdwp
2	Pulse Analog & Digital Modulation	https://www.youtube.com/watch?v=TM47sEXeaj8&list=PLDp9Jik5WjRvjqQ6ruRFC6hZcxnOsp3BE
3	Digital Carrier Modulation And Demodulation Techniques	https://www.youtube.com/watch?v=01zv0thaAUw

Course Code	**LC-ECE-220B**				
Category	Professional Core Courses				
Course Title	**Analog Electronics Circuit Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand the characteristics and AC analysis of RC coupled amplifiers. ● To understand the operation and characteristics of different oscillators, regulators and timers. ● To understand the operation of the power supply.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Analyze the characteristics and frequency response of different transistor amplifier configurations.
CO2	Examine the effects of negative feedback topologies on the performance of amplifiers.
CO3	Apply oscillator and op-amp principles to design and analyze circuits for signal generation and processing.
CO4	Demonstrate and apply the principles and working operations of IC regulators, SMPS, and 555 timers in analog circuits.

List of Experiments

Sr. No.	Contents
1	To analyze and study frequency response of RC coupled amplifier.
2	To analyze and study different types of feedback topologies.
3	To analyze and study RC phase shift oscillator.
4	To analyze and study the wein bridge oscillator.
5	To analyze and study three terminal IC voltage regulator.
6	To draw characteristics of a transistor.
7	To analyze and study inverting and non-inverting op-amp amplifiers.
8	To analyze and study the 555 timer as a square wave generator.
9	To analyze and study SMPS power supply.
10	To analyze and study working of Push-Pull amplifiers.
11	To analyze and study op-amp amplifiers as a differentiator.
12	To analyze and study op-amp amplifiers as an integrator.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Frequency response of RC coupled amplifier.	https://www.youtube.com/watch?v=ru72wlF6epU
2	Characteristics of a transistor.	https://www.youtube.com/shorts/8dN_4qNJALE
3	555 timer as a square wave generator	https://www.youtube.com/shorts/wjN-7eiuIgY
4	Wein bridge oscillator	https://www.youtube.com/watch?v=_TD0xG5FbCs
5	SMPS	https://www.youtube.com/shorts/5DQP-41mlQk
6	Working of Push-Pull amplifier	https://www.youtube.com/watch?v=NuW2ztF27R8
7	Inverting and non-inverting op-amp amplifiers	https://www.youtube.com/watch?v=EOZyofNXWXc

Course Code	**LC-ECE-222B**				
Category	Professional Core Courses				
Course Title	**Digital Electronics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To learn the basics of digital electronics and use logic gates and ICs. ● To design and check different combinational and sequential logic circuits. ● To understand the working operation of adders, subtractors, multiplexers, flip-flops, and counters in digital systems. ● To learn to build and test ADC, DAC, and practical counters for various applications.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Understand and apply operational principles of logic gates used in digital systems.
CO2	Analyze and verify the operation of sequential circuits used in digital systems
CO3	Verify the truth tables and behavior of combinational circuits with different states and inputs.
CO4	Perform and verify the operation of ADC and DAC circuits for digital system applications.

List of Experiments

Sr.No.	Contents
1	To study the operation of logic gates and verify their truth tables.
2	To verify the operation of universal gates.
3	To design and verify the operation of Binary-to-Gray and Gray-to-Binary code converters.
4	To design Half Adder and Full Adder circuits using gates.
5	To design and verify the operation of Half Subtractor and Full Subtractor circuits.
6	To study and verify the operation of Multiplexer and De-Multiplexer circuits.
7	To study the operation of Encoder and Decoder circuits.
8	To design and verify the operation of BCD-to-Seven Segment Decoder circuits.
9	To analyze and verify the operation and characteristic behavior of S-R, J-K, T, and D flip-flops under different input conditions.
10	To design and verify the operation of Decade counter using JK flip flops.
11	To design and verify the operation of 4-bit SISO and SIPO shift registers.
12	To analyze and verify the operation and performance characteristics of ADC and DAC circuits for digital system applications.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	To study & design basic gates.	https://de-iitr.vlabs.ac.in/exp/truth-table-gates/
2	To study and realize logic functions with the help of universal gates.	https://de-iitr.vlabs.ac.in/exp/half-full-adder/
3	To verify the operation of Multiplexer & De-multiplexer.	https://de-iitr.vlabs.ac.in/exp/multiplexer-demultiplexer/
4	To perform half adder and full adder	https://de-iitr.vlabs.ac.in/exp/half-full-adder/
5	To perform half subtractor and full subtractor.	https://de-iitr.vlabs.ac.in/exp/half-full-subtractor/index.html
6	To verify the truth table of S-R, J-K, T & D Type flip flop.	https://de-iitr.vlabs.ac.in/exp/truth-tables-flip-flops/
7	To design & verify the operation of 3 bit synchronous counter.	https://de-iitr.vlabs.ac.in/exp/4bit-synchronous-asynchronous-counter/
8	To design & verify operation of Asynchronous counter.	https://de-iitr.vlabs.ac.in/exp/4bit-synchronous-asynchronous-counter/

Course Code	**LC-ECE-224B**				
Category	Professional Core Courses				
Course Title	**Microprocessor and Microcontroller Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To understand architecture and working of Microprocessor and Microcontroller. • To learn assembly programming for arithmetic and data operations. • To provide hands-on experience in interfacing various peripherals with processor based systems.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Explain the architecture and functioning of microprocessors and microcontroller using model kits and instruction sets.
CO2	Develop and debug assembly language programs for arithmetic, logical and data manipulation tasks using instruction sets.
CO3	Apply interfacing techniques to connect peripherals with computing devices for practical applications.
CO4	Analyze embedded control algorithms for hardware interfacing and timing operations using microcontroller kit.

List of Experiments

Sr.No.	Contents
1	To study the architecture and functional blocks of the 8085 and 8086 microprocessors using trainer kit.
2	Write and execute program to perform arithmetic operations such as addition, subtraction, multiplication and division using 8085 instruction set.
3	Write a program to add the content of the memory location to the content of other memory location and store the result in 3rd memory location using 8086 instruction set.
4	Write a program to add 16 bit number using 8086 instruction set.
5	Write a program for multiplication of two 16 bit numbers using 8086 instruction set.
6	Write a program for division of two 16 bit numbers using 8086 instruction set.
7	Write a program to calculate the factorial of a given number using the 8086 instruction set.
8	Write a program to find the average of two given numbers using the 8086 instruction set.
9	Write a program to find the largest number in a data array using 8086 Instruction set.
10	Write and execute an 8086 assembly language program to interface and control a stepper motor using the 8255 (PPI).
11	To study the architecture and functioning of the 8051 microcontroller using trainer kit.
12	Write and execute a program to generate a square wave using the 8051 microcontroller.
13	Write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Introduction of Microprocessor 8085 Trainer Kit. Introduction of Microprocessor 8086 Trainer Kit	https://www.youtube.com/watch?v=GsPxk6GYf2Y&list=PLbEc0iDORYCp1yLvEfNxbZOZ4lTPUv_4f https://www.youtube.com/watch?v=GZibA34SU0c
2	Write a program to find the average of two given numbers using the 8086 instruction set.	https://www.youtube.com/watch?v=nOt9Wa-ClRo&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=10
3	Write a program to find the largest number in a data array using 8086 Instruction set.	https://www.youtube.com/watch?v=vNRGKG8ujVc&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=12
4	Write a program to calculate the factorial of a given number using the 8086 instruction set..	https://www.youtube.com/watch?v=riliLJP0Q_0&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=13
5	To write and execute an 8086 assembly language program to interface a stepper motor using 8255 PPI and control its rotation.	https://www.youtube.com/watch?v=lj5L1nGZAwg
6	To write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.	https://www.youtube.com/watch?v=aGVn4xGrAfY

Course Code	**PROJ-226B**				
Category	PROJECT				
Course Title	**Project Based Learning/Micro Project**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To expose students to domains related real-world engineering problem. • To introduce structured approaches for project planning, execution, documentation and technical presentation. • To enable the use of engineering concepts, tools and technologies for developing practical project solutions. • To create awareness of ethical, economic, environmental, and sustainability considerations in engineering projects.				
Assessment	25 Marks				
End Semester Examination	-				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify domain specific real world or engineering problems and applications suitable for project development.
CO2	Explain the principles, methodology and systematic process for project execution, reporting and technical presentation.
CO3	Apply appropriate engineering knowledge, tools and techniques to develop solutions for identified problem.
CO4	Analyze ethical practices, economics associated with different technologies suitable for project development.
CO5	Justify design choices, performance parameters, and technical constraints of the developed solution.
CO6	Design and develop a cost effective, environmental friendly, functional prototype addressing a defined engineering problem.

Guidelines:

- The Project Based Learning (PBL)/Micro Project course is intended to promote experiential learning, innovation, creativity, critical thinking and problem-solving abilities through the development of a small-scale engineering project, case study, technical model, simulation, design activity or technical presentation.
- Students shall undertake the project individually or in groups consisting of a maximum of four members under the guidance and supervision of an assigned faculty mentor.
- The project shall focus on identifying and addressing a real-world problem, engineering challenge, societal need, industry requirement, sustainability issue, or emerging technological application relevant to Electronics and Communication Engineering or allied disciplines.
- Students shall perform a preliminary study involving literature survey, technology review, need analysis,

problem investigation, market survey, or application analysis to identify a suitable project topic.

- The selected work shall contribute to the attainment of Course Outcomes (COs), Programme Outcomes (POs), Programme Specific Outcomes (PSOs), UNSDGs and Washington Accord Knowledge Profiles (WK1-WK8).
- In consultation with the faculty mentor, students shall define the problem statement, objectives, scope of work, methodology, resource requirements, implementation plan and expected outcomes.
- The project shall incorporate considerations related to technical feasibility, functionality, safety, reliability, cost effectiveness, environmental impact, sustainability and ethical engineering practices wherever applicable.
- Faculty mentors shall conduct periodic reviews to monitor progress and provide guidance related to technical development, project management, documentation, presentation skills, innovations and professional practices.
- Students shall demonstrate teamwork, communication skills, leadership qualities, professional ethics, accountability and effective time management throughout the project duration.
- Continuous assessment shall be carried out through periodic reviews, demonstrations, project documentation and viva-voce examinations based on predefined rubrics.
- The final report shall include the problem statement, objectives, literature review, methodology, design approach, implementation details, results, analysis, conclusions, limitations and future scope of work.

Course Code	**MECEVLSI-201B**				
Course Title	**VLSI Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • To introduce the basics of MOS fundamentals, fabrication technology and CMOS process steps. • To explain layout design rules, stick diagrams, and lambda-based design methodology. • To understand the complete VLSI design flow from RTL to GDSII using CAD tools. • To develop the ability to apply CAD tools for chip-level design and verification through case studies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Define VLSI evolution, Moore's Law and complete IC fabrication process flow stages.
CO2	Explain MOS capacitor and MOSFET operation, scaling concepts and short-channel effects in modern devices.
CO3	Apply CMOS fabrication processes, lithography, etching, metallization and integration techniques.
CO4	Analyze advanced VLSI technologies, reliability issues and TCAD-based process and device simulations.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to VLSI Technology: Evolution of IC technology: SSI, MSI, LSI, VLSI, ULSI and Moore's Law and scaling challenges. Overview of fabrication process flow (wafer preparation, oxidation, lithography, etching, doping), Comparison of VLSI Design vs VLSI Technology focus, metallization, planarization (CMP), detailed process integration

Unit-II

MOSFET Fundamentals & Scaling: - MOS capacitor and MOSFET structure, Threshold voltage, channel formation, short-channel effects, Scaling theories, constant field scaling, constant voltage scaling, High-k dielectrics, metal gates, Fin FETs. MOSFET I–V characteristics, velocity saturation, sub threshold conduction, DIBL, mobility degradation.

Unit-III

Fabrication Technology: -Wafer fabrication steps: oxidation, diffusion, ion implantation, Photolithography and mask design, Etching techniques (wet, dry, plasma), Metallization and interconnect technology, Process integration for CMOS, CMP, isolation techniques, advanced lithography.

Unit-IV

Advanced VLSI Technology: -Low-power and high-speed technology trends, SOI (Silicon-on-Insulator), Emerging technologies, Reliability issues: hot carrier effects, NBTI, electro migration, TCAD basics, process and RTL device/Process/device simulation basics. Reliability testing methodologies, Packaging and yield issues.

Suggested Readings

- VLSI Technology by Simon M. Sze (McGraw Hill)
- CMOS VLSI Design: A Circuits and Systems Perspective by Neil H.E. Weste & David Harris
- Introduction to VLSI Design Flow by Sneh Saurabh
- VLSI Fabrication Principles: Silicon and Gallium Arsenide by Sorab K. Ghandhi
- Modern VLSI Design: System-on-Chip Design by Wayne Wolf

Useful Video Links

Unit No.	Topic	Link
Unit-I	Evolution of IC technology	https://www.youtube.com/watch?v=g6CCJAbdkK8&list=PLHO2NKv71TvsSqYwVvUCZwNkY-jUyUHdS
	Overview of fabrication process flow	https://www.youtube.com/watch?v=Uj0QJliffcI
Unit-II	MOS capacitor and MOSFET structure	https://www.youtube.com/watch?v=faiEVOOCe-s
	short-channel effects, High-k dielectrics	https://www.youtube.com/watch?v=ftdNBEwNDm0
Unit-III	Wafer fabrication steps Photolithography Etching techniques.	https://www.youtube.com/watch?v=Tacv0fA9n_s
	Metallization and interconnect technology.	https://www.youtube.com/watch?v=HSn3G3r69QE&list=PLLy_2iUCG87AMeXL_nGl5_6-L-hD8IK6i
Unit-IV	Low-power and high-speed technology trends.	https://www.youtube.com/watch?v=KvN3JXICzdM
	Emerging technologies: CNTFETs, TFETs, Quantum devices.	https://www.youtube.com/watch?v=U9I9yFTxa6c&list=PLwdnzlV3ogoVGGv52O5biztwOcUewLEf5

NPTEL Link

nptel.ac.in/courses/117106093

Course Code	**MECEVLSI-202B**				
Course Title	**Digital Design with Verilog**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • To introduce the fundamentals of Boolean algebra, logic gates, and HDL programming. • To explain the design and implementation of combinational and sequential circuits using HDL and CMOS concepts. • To understand finite state machines (FSMs), test benches, and simulation for digital systems. • To develop the ability to prototype digital designs on FPGA platforms and analyze performance.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Define Boolean algebra concepts, truth tables, logic gates, and canonical representations of digital logic.
CO2	Explain CMOS logic principles and structural behavior of digital circuits.
CO3	Simplify Boolean expressions and design combinational, sequential, and finite state machine circuits.
CO4	Analyze FPGA architecture, timing constraints and resource utilization for digital circuit implementation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Logic Fundamentals & Boolean Algebra: Boolean laws, truth tables, canonical forms (SOP, POS), Number Systems, Logic gates, Base conversions and signed number representation (1's & 2's only),Binary codes, Code converters, Prime Implicants, Minimization techniques: K-map, Quine-McCluskey(Tabulation method).

Unit-II

Combinational Circuit Design: CMOS Combinational Circuit: Design Half Adder, Full Adder, Multiplexer and Demultiplexer using CMOS. CMOS Sequential logic circuits: Design SR latch, SR flip flop, JK flip flop, D flip flop using CMOS. Comparator design, parity checker, decoders, multipliers. Ripple carry adder, Carry look-ahead adder.BCD adders, code converters.

Unit-III

Sequential Circuit Design: Flip-flops (SR, JK, D, T) – CMOS latch and flip-flop design Registers (SISO, SIPO, PISO, PIPO) – CMOS register structures, Counters (asynchronous, synchronous, modulo N) – CMOS counter design, FSMs (Mealy & Moore) withVerilog.FSM minimization techniques, Implementation of flip-flops, counters, and registers in Verilog, ASM charts.RTL sequential multiplier.

Unit-IV

HDL Modeling & FPGA Prototyping: VHDL/Verilog syntax, modeling styles (behavioral, dataflow, structural) Test benches and simulation (Model Sim, Viv ado) FPGA synthesis, mapping, implementation, FSM testing, ASM methodology, Timing constraints and clock distribution in FPGA and optimization strategies.

Suggested Readings

- Digital Logic Circuits: With VHDL and Verilog Programs – A. Nagoor Kani
- Fundamentals of Digital Logic with VHDL Design – Stephen D. Brown & Zvonko Vranesic
- Digital Design: With an Introduction to Verilog HDL – M. Morris Mano & Michael Ciletti
- Digital Design Using Verilog- Charles H. Roth Jr., Lizy Kurian John
- Digital Systems Design Using Verilog-Charles H. Roth Jr., Lizy Kurian John
- Verilog Digital System Design-Zainalabedin Navabi

Useful Video Links

Unit No.	Topic	Link
Unit-I	Boolean laws	https://www.youtube.com/watch?v=yqDDwJalxUk
	Minimization using k- map	https://www.youtube.com/watch?v=BPBiyzc0OBw
Unit-II	Design Half Adder	https://www.youtube.com/watch?v=85XxQZqBNlg
	CMOS Sequential logic circuit: Design SR latch	https://www.youtube.com/watch?v=jm0PGDSSBkI
Unit-III	Logic Gate design using pass transistor:	https://www.youtube.com/watch?v=eqnMAaYU4OY
	Basic principle, non-ideal effects, domino CMOS logic, high performance dynamic CMOS circuits, clocking issues, clock distribution	https://www.youtube.com/watch?v=q8adOpQx7tc
Unit-IV	VLSI design methodology, design Hierarchy	https://www.youtube.com/watch?v=9QgdNsl9qwk&list=PLyqSpQzTE6M8iOrfy70ELk9W72JG5a98V
	Lambda-based design rules.	https://www.youtube.com/watch?v=OAxIm8up7QY

NPTEL Link

nptel.ac.in/courses/106103358

Course Code	MLECEVLSI-203B				
Course Title	Digital Design with Verilog Lab				
Scheme and Credits	L	T	P	Credits	Semester-III/IV
	0	0	2	1	
Course Objectives	The objectives of this course are • To introduce HDL programming for combinational and sequential circuits. • To explain FSM modeling and simulation using CAD tools • To understand FPGA synthesis and mapping of digital designs. • To develop the ability to analyze timing and functionality of FPGA prototypes.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Design combinational digital circuits using HDL and demonstrate their functional behavior through simulation results.
CO2	Design sequential digital circuits using HDL and their functional operation through simulation.
CO3	Realize finite state machine–based digital systems using HDL and implement them on FPGA platforms.
CO4	Evaluate HDL-based digital designs by judging logical correctness and timing performance using simulation waveforms.

List of Experiments

Sr. No.	Contents
1	Design of half-adder and full adder using Verilog/VHDL.
2	Design and verify multiplexer and de-multiplexer circuits using HDL.
3	Implement and simulate encoder and decoder circuits using HDL.
4	Develop HDL models for basic logic gates and verify their logical operation.
5	Design and simulate SR, JK, D, and T flip-flops using HDL.
6	Implement up, down, and modulo-N counters using HDL.
7	Design and simulate SISO, SIPO, PISO, and PIPO registers using HDL.
8	Implement CMOS-based latches and flip-flops and study their sequential behavior.
9	Design and simulate a traffic light controller using finite state machine modeling in HDL.
10	Model and verify Mealy and Moore finite state machines using HDL.

Useful Video Links

Sr. No.	Topic	Link
1	Design of half-adder and full adder using Verilog/VHDL.	https://youtu.be/lDbQq_t3N8I
2	Multiplexer and Demultiplexer design with HDL.	https://www.youtube.com/watch?v=BbhJnd0A9dI
3	Encoder and decoder implementation	https://www.youtube.com/watch?v=uiQuoUxPJZY
4	HDL coding for basic gates (AND, OR, NOT, NAND, NOR, XOR).	https://www.youtube.com/playlist?list=PLgwJf8NK-2e5JBJcNCZ7tqc2XjbezGjS8
5	Traffic light controller using FSM in Verilog.	https://www.youtube.com/watch?v=hJhBhEcCc-c
6	HDL modeling of Mealy and Moore FSMs	https://www.youtube.com/watch?v=EzMWYmRkHFQ&list=PLBlnK6fEyqRhduNC2PI4FPJqAhwoNTe1d

Annexure AC/5.7

~~Annexure – 4.0~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute
'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme & Syllabus

For

Minor/ Honors (Hons.)/ Specialization

in

VLSI Design and Technology

Department of Electronics & Communication Engineering

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

Minor Degree/Honors (Hons.)/Specialization

in

VLSI Design and Technology

Offered by Department of Electronics & Communication Engineering

VLSI (Very Large Scale Integration) Design and Technology is a specialized and rapidly evolving branch of Electronics & Communication Engineering concerned with the design, development, verification, and fabrication of integrated circuits (ICs) containing millions to billions of transistors on a single silicon chip. It forms the technological backbone of the modern semiconductor and electronics industry, powering consumer electronics, telecommunications, automotive systems, artificial intelligence hardware, and IoT devices. With the Government of India's continued thrust on the semiconductor mission and self-reliance in chip design and manufacturing, the demand for skilled VLSI professionals is growing rapidly. Institutions and Universities must incorporate them into education, training and research.

Keeping the above in view, the Department of Electronics & Communication Engineering has started a Minor Degree/Honors (Hons.)/Specialization in "VLSI Design and Technology" from the academic session 2025–26, with the aim of enhancing students' employability skills and imparting in-depth knowledge in emerging areas that are usually not covered in the undergraduate degree framework. These emerging areas will help students tap into the wide range of employment opportunities available in these domains.

This Minor Degree/Honors (Hons.)/Specialization will require earning 20 credits. It will be an addition to the regular undergraduate program, implying that passing or failing it will not affect the results of the regular undergraduate program being pursued by the student. Upon successful completion of the course, a Minor Degree/Honors (Hons.)/Specialization shall be awarded to the candidate. Students of Electronics & Communication Engineering and other engineering programs shall be eligible for the Minor Degree/Honors (Hons.)/Specialization as outlined below:

Name of the Minor Degree/Honors (Hons.)/Specialization	**B. Tech Program whose students are eligible to opt for Minor Degree**	**B. Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization**
VLSI Design and Technology	All Branches except Electronics & Communication Engineering and Electrical Engineering	Electronics & Communication Engineering and Electrical Engineering

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

Minor/ Honors (Hons.) / Specialization in VLSI Design and Technology

w.e.f. 2026-27

Sr. No.	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration inHrs
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	MECEVLSI-201B	VLSI Technology	4	0	0	4	4	40	60		100	3
2	IV	MECEVLSI-202B	Digital Design with Verilog	4	0	0	4	4	40	60		100	3
3	IV	MLECEVLSI-203B	Digital Design with Verilog Lab	0	0	2	2	1	10		15	25	-
4	V	MECEVLSI-301B	Low Power VLSI Circuits & Systems	4	0	0	4	4	40	60		100	3
5	VI	MECEVLSI-302B	Analog VLSI Design	4	0	0	4	4	40	60		100	3
6	VI	MLECEVLSI-303B	Analog VLSI Design Lab	0	0	2	2	1	10		15	25	-
7	VII	MLECEVLSI-402B	Project Work	0	0	4	4	2	20		30	50	-
Total Credits								**20**				**500**	

Note: To earn the required credits for the award of B.Tech Minor/Honors (Hons.)/Specialization Degree, students may choose either:

(i) To enroll in courses offered through NPTEL/MOOCs that must be equivalent to the prescribed courses in the approved scheme, subject to availability in any semester.

OR

(ii) To complete the prescribed courses in the same semester as offered by the department under the approved scheme and curriculum structure.

Course Code	MECEVLSI-201B				
Course Title	VLSI Technology				
Scheme and Credits	L	T	P	Credits	Semester-III/IV
	4	0	0	4	
Course Objectives	The objectives of this course are • To introduce the basics of MOS fundamentals, fabrication technology and CMOS process steps. • To explain layout design rules, stick diagrams, and lambda-based design methodology. • To understand the complete VLSI design flow from RTL to GDSII using CAD tools. • To develop the ability to apply CAD tools for chip-level design and verification through case studies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define VLSI evolution, Moore's Law and complete IC fabrication process flow stages.
CO2	Explain MOS capacitor and MOSFET operation, scaling concepts and short-channel effects in modern devices.
CO3	Apply CMOS fabrication processes, lithography, etching, metallization and integration techniques.
CO4	Analyze advanced VLSI technologies, reliability issues and TCAD-based process and device simulations.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to VLSI Technology: Evolution of IC technology: SSI, MSI, LSI, VLSI, ULSI and Moore's Law and scaling challenges. Overview of fabrication process flow (wafer preparation, oxidation, lithography, etching, doping), Comparison of VLSI Design vs VLSI Technology focus, metallization, planarization (CMP), detailed process integration

Unit-II

MOSFET Fundamentals & Scaling: - MOS capacitor and MOSFET structure, Threshold voltage, channel formation, short-channel effects, Scaling theories, constant field scaling, constant voltage

scaling, High-k dielectrics, metal gates, Fin FETs. MOSFET I–V characteristics, velocity saturation, sub threshold conduction, DIBL, mobility degradation.

Unit-III

Fabrication Technology: -Wafer fabrication steps: oxidation, diffusion, ion implantation, Photolithography and mask design, Etching techniques (wet, dry, plasma), Metallization and interconnect technology, Process integration for CMOS, CMP, isolation techniques, advanced lithography.

Unit-IV

Advanced VLSI Technology: -Low-power and high-speed technology trends, SOI (Silicon-on-Insulator), Emerging technologies, Reliability issues: hot carrier effects, NBTI, electro migration, TCAD basics, process and RTL device/Process/device simulation basics. Reliability testing methodologies, Packaging and yield issues.

Suggested Readings

- VLSI Technology by Simon M. Sze (McGraw Hill)
- CMOS VLSI Design: A Circuits and Systems Perspective by Neil H.E. Weste & David Harris
- Introduction to VLSI Design Flow by Sneh Saurabh
- VLSI Fabrication Principles: Silicon and Gallium Arsenide by Sorab K. Ghandhi
- Modern VLSI Design: System-on-Chip Design by Wayne Wolf

Useful Video Links

Unit No.	Topic	Link
Unit-I	Evolution of IC technology	https://www.youtube.com/watch?v=g6CCJAbdkK8&list=PLHO2NKv71TvsSqYwVvUCZwNkY-jUyUHdS
	Overview of fabrication process flow	https://www.youtube.com/watch?v=Uj0QJliffcI
Unit-II	MOS capacitor and MOSFET structure	https://www.youtube.com/watch?v=faiEVOOCe-s
	short-channel effects, High-k dielectrics	https://www.youtube.com/watch?v=ftdNBEwNDm0
Unit-III	Wafer fabrication steps Photolithography Etching techniques.	https://www.youtube.com/watch?v=Tacv0fA9n_s
	Metallization and interconnect technology.	https://www.youtube.com/watch?v=HSn3G3r69QE&list=PLLy_2iUCG87AMeXL_nGl5_6-L-hD8IK6i
Unit-IV	Low-power and high-speed technology trends.	https://www.youtube.com/watch?v=KvN3JXICzdM
	Emerging technologies: CNTFETs, TFETs, Quantum devices.	https://www.youtube.com/watch?v=U9I9yFTxa6c&list=PLwdnzlV3ogoVGGv52O5biztwOcUewLEf5

NPTEL Link

nptel.ac.in/courses/117106093

Course Code	MECEVLSI-202B				
Course Title	Digital Design with Verilog				
Scheme and Credits	L	T	P	Credits	Semester-III/IV
	4	0	0	4	
Course Objectives	The objectives of this course are • To introduce the fundamentals of Boolean algebra, logic gates, and HDL programming. • To explain the design and implementation of combinational and sequential circuits using HDL and CMOS concepts. • To understand finite state machines (FSMs), test benches, and simulation for digital systems. • To develop the ability to prototype digital designs on FPGA platforms and analyze performance.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	**Define Boolean algebra concepts, truth tables, logic gates, and canonical representations of digital logic.**
CO2	**Explain CMOS logic principles and structural behavior of digital circuits.**
CO3	**Simplify Boolean expressions and design combinational, sequential, and finite state machine circuits.**
CO4	**Analyze FPGA architecture, timing constraints and resource utilization for digital circuit implementation.**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/sections) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Logic Fundamentals & Boolean Algebra: Boolean laws, truth tables, canonical forms (SOP, POS), Number Systems, Logic gates, Base conversions and signed number representation (1's & 2's only),Binary codes, Code converters, Prime Implicants, Minimization techniques: K-map, Quine-McCluskey(Tabulation method).

Unit-II

Combinational Circuit Design: CMOS Combinational Circuit: Design Half Adder, Full Adder, Multiplexer and Demultiplexer using CMOS. CMOS Sequential logic circuits: Design SR latch, SR flip flop, JK flip flop, D flip flop using CMOS. Comparator design, parity checker, decoders, multipliers. Ripple carry adder, Carry look-ahead adder.BCD adders, code converters.

Unit-III

Sequential Circuit Design: Flip-flops (SR, JK, D, T) – CMOS latch and flip-flop design Registers (SISO, SIPO, PISO, PIPO) – CMOS register structures, Counters (asynchronous, synchronous, modulo N) – CMOS counter design, FSMs (Mealy & Moore) withVerilog.FSM minimization techniques, Implementation of flip-flops, counters, and registers in Verilog, ASM charts.RTL sequential multiplier.

Unit-IV

HDL Modeling & FPGA Prototyping: VHDL/Verilog syntax, modeling styles (behavioral, dataflow, structural) Test benches and simulation (Model Sim, Viv ado) FPGA synthesis, mapping, implementation, FSM testing, ASM methodology, Timing constraints and clock distribution in FPGA and optimization strategies.

Suggested Readings

- Digital Logic Circuits: With VHDL and Verilog Programs – A. Nagoor Kani
- Fundamentals of Digital Logic with VHDL Design – Stephen D. Brown & Zvonko Vranesic
- Digital Design: With an Introduction to Verilog HDL – M. Morris Mano & Michael Ciletti
- Digital Design Using Verilog- Charles H. Roth Jr., Lizy Kurian John
- Digital Systems Design Using Verilog-Charles H. Roth Jr., Lizy Kurian John
- Verilog Digital System Design-Zainalabedin Navabi

Useful Video Links

Unit No.	Topic	Link
Unit-I	Boolean laws	https://www.youtube.com/watch?v=yqDDwJalxUk
	Minimization using k- map	https://www.youtube.com/watch?v=BPBiyzc0OBw
Unit-II	Design Half Adder	https://www.youtube.com/watch?v=85XxQZqBNlg
	CMOS Sequential logic circuit: Design SR latch	https://www.youtube.com/watch?v=jm0PGDSSBkI
Unit-III	Logic Gate design using pass transistor:	https://www.youtube.com/watch?v=eqnMAaYU4OY
	Basic principle, non-ideal effects, domino CMOS logic, high performance dynamic CMOS circuits, clocking issues, clock distribution	https://www.youtube.com/watch?v=q8adOpQx7tc
Unit-IV	VLSI design methodology, design Hierarchy	https://www.youtube.com/watch?v=9QgdNsl9qwk&list=PLyqSpQzTE6M8iOrfy70ELk9W72JG5a98V
	Lambda-based design rules.	https://www.youtube.com/watch?v=OAxIm8up7QY

NPTEL Link

nptel.ac.in/courses/106103358

Course Code	MLECEVLSI-203B				
Course Title	Digital Design with Verilog Lab				
Scheme and Credits	L	T	P	Credits	Semester-III/IV
	0	0	2	1	
Course Objectives	The objectives of this course are • To introduce HDL programming for combinational and sequential circuits. • To explain FSM modeling and simulation using CAD tools • To understand FPGA synthesis and mapping of digital designs. • To develop the ability to analyze timing and functionality of FPGA prototypes.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Design combinational digital circuits using HDL and demonstrate their functional behavior through simulation results.
CO2	Design sequential digital circuits using HDL and their functional operation through simulation.
CO3	Realize finite state machine–based digital systems using HDL and implement them on FPGA platforms.
CO4	Evaluate HDL-based digital designs by judging logical correctness and timing performance using simulation waveforms.

List of Experiments

Sr. No.	Contents
1	Design of half-adder and full adder using Verilog/VHDL.
2	Design and verify multiplexer and de-multiplexer circuits using HDL.
3	Implement and simulate encoder and decoder circuits using HDL.
4	Develop HDL models for basic logic gates and verify their logical operation.
5	Design and simulate SR, JK, D, and T flip-flops using HDL.
6	Implement up, down, and modulo-N counters using HDL.
7	Design and simulate SISO, SIPO, PISO, and PIPO registers using HDL.
8	Implement CMOS-based latches and flip-flops and study their sequential behavior.
9	Design and simulate a traffic light controller using finite state machine modeling in HDL.
10	Model and verify Mealy and Moore finite state machines using HDL.

Useful Video Links

Sr. No.	Topic	Link
1	Design of half-adder and full adder using Verilog/VHDL.	https://youtu.be/lDbQq_t3N8I
2	Multiplexer and Demultiplexer design with HDL.	https://www.youtube.com/watch?v=BbhJnd0A9dI
3	Encoder and decoder implementation	https://www.youtube.com/watch?v=uiQuoUxPJZY
4	HDL coding for basic gates (AND, OR, NOT, NAND, NOR, XOR).	https://www.youtube.com/playlist?list=PLgwJf8NK-2e5JBJcNCZ7tqc2XjbezGjS8
5	Traffic light controller using FSM in Verilog.	https://www.youtube.com/watch?v=hJhBhEcCc-c
6	HDL modeling of Mealy and Moore FSMs	https://www.youtube.com/watch?v=EzMWYmRkHFQ&list=PLBlnK6fEyqRhduNC2PI4FPJqAhwoNTe1d

Annexure AC / 5.8

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR
An Autonomous Institute | NAAC 'A' Grade Institute | Affiliated to MDU, Rohtak

MINUTES OF 4TH MEETING OF THE BOARD OF STUDIES OF COMPUTER SCIENCE AND ENGINEERING DEPARTMENT

The 4th meeting of Board of Studies of Computer Science and Engineering Department was held on 06.06.2026 at 10:30 A.M in the office of Computer Science and Engineering Department.

The following members were present for BOS meeting:

SN	Name of the Member	Affiliation/Organization	Designation within Board of Studies
1	Dr. Nitin Kumar	HOD, CSE, GITAM Kablana	Chairperson
2	Prof. Yudhvir Singh	Director, UIET, MDU, Rohtak, University Nominee	Member
3	Prof. Yogesh Chaba	Subject Expert (Professor, CSE, GJU Science & Technology, Hisar), Outside Parent University	Member
4	Prof. Namita Gupta	Subject Expert (Professor, CSE, MAIT, New Delhi), Outside Parent University	Member
5	Dr. Pramod Kumar	Associate Professor, GITAM Kablana	Member
6	Dr. Poonam	Assistant Professor, GITAM Kablana	Member
7	Dr. Priyanka Rani	Assistant Professor, GITAM Kablana	Member
8	Ms. Upasna	Assistant Professor, GITAM Kablana	Member
9	Mr. Rahul	Assistant Professor, GITAM Kablana	Member
10	Mr. Jitender Kumar	Assistant Professor, GITAM Kablana	Member
11	Ms. Nisha Rani	Assistant Professor, GITAM Kablana	Member
12	Ms. Ritu Kadyan	Assistant Professor, GITAM Kablana	Member
13	Ms. Manjali	Assistant Professor, GITAM Kablana	Member
14	Ms. Aakansha	Assistant Professor, GITAM Kablana	Member
15	Mr. Tarun Kumar	Assistant Professor, GITAM Kablana	Member
16	Ms. Naveen	Assistant Professor, GITAM Kablana	Member
17	Ms. Ritu Lohchab	Assistant Professor, GITAM Kablana	Member
18	Ms. Preeti Sharma	Assistant Professor, GITAM Kablana	Member
19	Mr. Vikas	Assistant Professor, GITAM Kablana	Member
20	Mr. Vikas	Assistant Professor, GITAM Kablana	Member
21	Mr. Arihant Jain	Alumni	Member

At the outset, the Chairperson welcomed all the members and thanked them for their valuable presence. The agenda items were taken up for discussion as follows:

Item 4.1	**Confirmation of the minutes of 3rd Meeting of the Board of Studies of Computer Science and Engineering Department held on 27.12.2025.** To confirm the minutes of 3rd meeting of the Board of Studies of Computer Science and Engineering Department held on 27.12.2025 **(Annexure 4.1, Pages 1-4 already circulated).** **RESOLVED THAT THE MINUTES OF 3RD MEETING OF THE BOARD OF STUDIES OF COMPUTER SCIENCE AND ENGINEERING DEPARTMENT HELD ON 27.12.2025 (ANNEXURE 4.1, PAGES 1-4 ALREADY CIRCULATED) BE CONFIRMED.**
Item 4.2	**Follow-up action report on the decisions taken in the 3rd meeting of the Board of Studies of Computer Science and Engineering Department held on 27.12.2025.** To note the follow-up action on the decisions taken in the 3rd meeting of the Board of Studies of Computer Science and Engineering Department held on 27.12.2025 **(Annexure 4.2, Pages 5-6 already circulated).** **RESOLVED THAT THE FOLLOW-UP ACTION ON THE DECISIONS TAKEN IN THE 3RD MEETING OF BOARD OF STUDIES OF COMPUTER SCIENCE AND ENGINEERING DEPARTMENT HELD ON 27.12.2025 BE NOTED (ANNEXURE 4.2, PAGES 5-6 ALREADY CIRCULATED).**
Item 4.3	**Scheme of Studies & Examinations and Syllabi (A-Scheme) for 3rd Year** **(a) B.Tech Computer Science and Engineering and B.Tech Computer Science and Engineering for Working Professionals** **(b) B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning** **(c) B.Tech Computer Science and Engineering-Data Science effective from the Academic Session 2026–27.** The Scheme of Studies & Examinations and Syllabi (A-Scheme) for the 2nd Year of B.Tech. Computer Science and Engineering Common with B.Tech. Computer Science and Engineering for Working Professionals, B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning (B.Tech CSE-AIML) and B.Tech Computer Science and Engineering-Data Science (B.Tech CSE-DS) was approved by the Board of Studies in its meeting held on 28th May, 2025 and subsequently approved by the Academic Council. The proposed Scheme of Studies & Examinations and Syllabi (A-Scheme) for 3rd Year of (a) B.Tech Computer Science and Engineering common to B.Tech Computer Science and Engineering for Working Professionals 3rd Year (Annexure 4.3(a), Pages 7-62) (b) B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning 3rd Year (Annexure 4.3(b), Pages 63-116), (c) B.Tech Computer Science and Engineering-Data Science 3rd Year (Annexure 4.3(c), Pages 117-173) effective from the Academic Session 2026–27 is placed before the Board. The Board of Studies may consider and approve the proposed Scheme of Studies & Examinations and Syllabi (A-Scheme), for 3rd year of the above programmes.

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI-(A SCHEME) FOR 3RD YEAR OF

(a) B.TECH COMPUTER SCIENCE AND ENGINEERING COMMON TO B.TECH COMPUTER SCIENCE AND ENGINEERING FOR WORKING PROFESSIONALS (ANNEXURE 4.3(A), PAGES 7-62)
(b) B.TECH COMPUTER SCIENCE AND ENGINEERING-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (ANNEXURE 4.3(B), PAGES 63-116),
(c) B.TECH COMPUTER SCIENCE AND ENGINEERING-DATA SCIENCE (ANNEXURE 4.3(C), PAGES 117-173).

FURTHER RESOLVED THAT SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI OF THE ABOVE MENTIONED AT (A)-(C) ARE RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.4

Syllabi of Open Elective Courses offered by Computer Science and Engineering Department for B.Tech. 3rd Year (Scheme-A) effective from the Academic Session 2026–27.

To approve the syllabi of the Open Elective Courses offered by Computer Science and Engineering Department for B.Tech. 3rd Year (Scheme-A) (Annexure 4.4, Pages 174-175)

Sr. No.	Course Code	Course	Offered by	Departments Eligible to Choose the Course
1	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments except the Department of Computer Science and Engineering
2	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

RESOLVED THAT THE SYLLABI OF OPEN ELECTIVE COURSES OFFERED BY COMPUTER SCIENCE AND ENGINEERING DEPARTMENT AS MENTIONED ABOVE FOR B.TECH 3RD YEAR (SCHEME-A), EFFECTIVE FROM THE SESSION 2026-2027 (ANNEXURE 4.4, PAGES 174-175) BE APPROVED.

FURTHER RESOLVED THAT SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.5

Scheme of Studies & Examinations and Syllabi (B-Scheme as per NEP-2020) common for 2nd year of B.Tech Computer Science and Engineering, B.Tech Computer Science and Engineering for Working Professionals 2nd Year, B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning

	and B.Tech Computer Science and Engineering-Data Science effective from the Academic Session 2026–27. The Institute implemented NEP-2020 effective from 2025-26 (For 1st Year). The Scheme of Studies & Examinations and Syllabi have been proposed accordingly common for 2nd year of B.Tech Computer Science and Engineering, B.Tech Computer Science and Engineering for Working Professionals, B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning and B.Tech Computer Science and Engineering-Data Science (Annexure 4.5, Pages 176–230). **THE BOARD OF STUDIES MAY CONSIDER AND APPROVE THE PROPOSED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (B-SCHEME AS PER NEP-2020), FOR 2ND YEAR OF THE ABOVE PROGRAMMES.** **RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI-(B-SCHEME AS PER NEP-2020) COMMON FOR 2ND YEAR OF B.TECH COMPUTER SCIENCE AND ENGINEERING, B.TECH COMPUTER SCIENCE AND ENGINEERING-WORKING PROFESSIONALS, B.TECH COMPUTER SCIENCE AND ENGINEERING-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING AND B.TECH COMPUTER SCIENCE AND ENGINEERING-DATA SCIENCE 2ND YEAR (ANNEXURE 4.5, PAGES 176–230).** **FURTHER RESOLVED THAT SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE ARE RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.**
Item 4.6	**Scheme of Studies & Examinations and Syllabi (B-Scheme) for** **(a) Honors (Hons.)/Specialization/Minor Degree in Cyber Security** **(b) Minor Degree in Data Science and** **(c) Minor Degree in Artificial Intelligence and Machine Learning effective from Academic Session 2026-27.** To enhance the employability and provide specialized knowledge in emerging technologies, the Department of Computer Science and Engineering has introduced (a) Honors (Hons.)/Specialization/Minor Degree in Cyber Security (Annexure 4.5(a) Pages 231-248) (b) Minor Degree in Data Science (Annexure 4.5(b) Pages 249-266) and (c) Minor Degree in Artificial Intelligence and Machine Learning (Annexure 4.5(c) Pages 267-284) effective from Academic Session 2026-27. The Minor/Honours Degree Programme shall carry 18 to 20 credits in addition to the credits essential for obtaining the Undergraduate Degree. The Board of Studies may consider and approve the Scheme of Studies & Examinations and Syllabi (B-Scheme), as mentioned above programmes. **RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (B-SCHEME) FOR** **(a) HONORS (HONS.)/SPECIALIZATION/MINOR DEGREE IN CYBER SECURITY (ANNEXURE 4.5(A) PAGES 231-248)**

	(b) MINOR DEGREE IN DATA SCIENCE (ANNEXURE 4.5(B) PAGES 249-266) AND **(c) MINOR DEGREE IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (ANNEXURE 4.5(C) PAGES 267-284) EFFECTIVE FROM ACADEMIC SESSION 2026-27.** **FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES AND EXAMINATIONS AND SYLLABUS AS MENTIONED ABOVE (A)-(C) BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR CONSIDERATION AND APPROVAL.**
Item 4.7	**Panel of Examiners for Theory and Practical Examinations of B.Tech and M.Tech Programme for Academic Session 2026-27.** The Board of Studies, in its meeting held on 27th Dec., 2025 vide its Resolution No. 3.4, approved the Panel of Examiners **(Annexure 4.7, Pages 285-288).** The Board of Studies may now review the existing panel to ensure the inclusion of additional eligible and qualified examiners, if required, to further strengthen the evaluation process for the upcoming academic year. **RESOLVED THAT THE BOARD OF STUDIES REVIEWED AND APPROVED THE PANEL OF EXAMINERS FOR THEORY AND PRACTICAL EXAMINATIONS FOR THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.7, PAGES 285-288).** **FURTHER RESOLVED THAT THE APPROVED PANEL BE FORWARDED TO THE CONTROLLER OF EXAMINATIONS FOR FURTHER NECESSARY ACTION.**
Item 4.8	**Any other item with the permission of Chair** There being no other item for discussion, the meeting concluded with a vote of thanks to the Chair.



Dr. Nitin Kumar
Chairperson
Board of Studies
Computer Science and Engineering Deptt.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations For

Bachelor of Technology Computer Science and Engineering (CSE)

Common With

Bachelor of Technology Computer Science and Engineering-Working Professional (CSE-WP)

3rd Year (A-Scheme)

Effective from the Academic Session 2026-27

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	2 Practical (P) per week	1 Credit
4	2 Seminar/Industrial Training per week	1 Credit

2. RANGE OF CREDIT

A range of credits from 160 to 180 is required for the award of an Undergraduate Degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	73*
2	Professional Elective Courses (Relevant to chosen specialization/branch)	12*
3	Engineering Science Courses	26*
4	Basic Science Courses	21*
5	Humanities and Social Sciences including Management courses	12*
6	Multidisciplinary Open Electives Courses	9*
7	Project work, seminar and internship in industry or appropriate work place/academic and research institutions in India/abroad	16*
8	Value Added Courses	01*
9	Mandatory Courses	Non Credit
	Total Credits	170*

***Minor variation is allowed as per need of the respective disciplines*

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses	PEC
3	Engineering Science Courses	ESC
4	Basic Science Courses	BSC
5	Humanities and Social Sciences including Management courses	HSMC
6	Multidisciplinary Open Electives Courses	MOEC
7	Value Added Courses	VAC
8	Project	PR
9	Mandatory Courses	MC
10	Lab Courses	LC
11	Practical Training	PT
12	Internship	INT

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Computer Science and Engineering – 5th Semester

Common with

B.Tech Computer Science and Engineering-Working Professional – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	CSE-301A	Computer Networks	3	0	0	3	3	40	60		100	3
2	Professional Core Courses	CSE-303A	Formal Languages and Automata	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	CSE-305A	Design and Analysis of Algorithms	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	CSE-307A	Programing in Java	3	1	0	4	4	40	60		100	3
5	Engineering Science Courses	ECE-001A	Microprocessor and Microcontroller	3	0	0	3	3	40	60		100	3
6	Professional Elective Courses	Refer Table-II	Professional Elective-II	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	CSE-L301A	Computer Networks Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	CSE-L305A	Design and Analysis of Algorithms Lab using C++	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	CSE-L307A	Programing in Java Lab	0	0	2	2	1	25		25	50	3
10	Engineering Science Courses	ECE-L001A	Microprocessor and Microcontroller Lab	0	0	2	2	1	25		25	50	3
11	Practical Training	PT-301A	Practical Training-I	0	0	2	2	1	50			50	-
Total Credits								**24**				**850**	

Note:

I. Students must choose one course from the Professional Elective–II category (Table II). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

II. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.. Students required getting passing marks otherwise, He / She will be required to repeat practical training-I.

Table II: Professional Elective - II

Sr. No.	Course Code	Course Title
1	CSE-309A	Distributed Systems
2	CSE-311A	Advanced Computer Architecture
3	CSE-313A	Computer Graphics
4	CSE-315A	Data Warehouse and Mining
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Computer Science and Engineering – 6th Semester

Common with

B.Tech Computer Science and Engineering-Working Professional –6th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	AI-301A	Machine Learning	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	CSE-001A	Compiler Design	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	CSE-302A	Web Technologies	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	CSE-304A	Software Engineering	3	0	0	3	3	40	60		100	3
5	Professional Elective Courses	Refer Professional Elective Table-III	Professional Elective-III	3	0	0	3	3	40	60		100	3
6	Multidisciplinary Open Elective Courses	Refer Multidisciplinary Open Elective-I Table-IV	Multidisciplinary Open Elective-I	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	AI-L301A	Machine Learning Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	CSE-L001A	Compiler Design Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	CSE-L302A	Web Technologies Lab	0	0	2	2	1	25		25	50	3
10	Mandatory Courses (Non-Credit)	MC-301A	Constitution of India	2	0	0	2	-	40	60			3
Total Credits								**22**				**750**	

Note:

I. MC-301A is a mandatory non –credit course in which the students will be required passing marks in theory. However these marks will not be added in the total marks.

II. Students must choose one course from the Professional Elective–III category (Table III) and one course from the Open Elective–I category (Table IV). They may also opt for Massive Open Online Courses (MOOCs) offered through the

SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

III. At the end of 6th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

IV. **For Working Professionals:** Students shall submit a Training/Project Report based on their work in their respective company/organization for the period of the summer/industrial training. The evaluation shall be carried out in the 7th Semester.

Table III: Professional Elective - III

Sr. No.	Course Code	Course Title
1	DS-303A	Predictive Analytics
2	CSE-306A	Software project Management
3	CSE-308A	Digital Image Processing
4	CSE-310A	Mobile Application Development
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)*

Table IV: Multidisciplinary Open Elective-I

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

<table>
<tr><td>Course code</td><td colspan="5">CSE-301A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Computer Networks</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To provide fundamental knowledge of computer networking concepts, architectures, communication models, and transmission techniques.
• To develop understanding of networking protocols, addressing methods, routing mechanisms, and network services across different layers.
• To enable students to apply networking principles and protocols for data communication and problem solving in computer networks.
• To develop analytical understanding of network performance, congestion control, QoS, Networking technologies, and security mechanisms.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts, models, protocols, devices, services, techniques, and security mechanisms of computer networks.	Level 1: Remember
CO2	Explain the principles, operations, functionalities, and interactions of computer networking components, protocols, architectures, and services.	Level 2: Understand
CO3	Apply networking concepts, protocols, algorithms, addressing methods, and security techniques to solve computer networking problems.	Level 3 : Apply
CO4	Analyze network performance, routing, QoS, congestion control, and security mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Data communication, Components, Computer networks and its historical development, distributed processing, network performance metrics (bandwidth, throughput, delay, jitter and packet loss), Internet Network **Models:** OSI model and TCP/IP Model.

Physical Layer: physical layer functions, Data Representation, Simplex, Half Duplex and Full Duplex Transmission, Modulation and Multiplexing, Packet and circuit switching, Transmission media, Topologies, connectionless and connection-oriented services.

Data Link Layer: Data link layer functions and services, MAC Addressing, Framing, flow control, error detection and correction (parity check, checksum, CRC and Hamming code), Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Unit-II

Medium Access Control: MAC layer functions, Random access, Controlled Access and channelization protocols, CSMA/CD and CSMA/CA.

Network Layer: Network layer functions and services, Logical addressing, IPv4 classful and classless addressing, subnetting, NAT, IPv4, ICMPv4, ARP, RARP and BOOTP, IPv6, IPv6 addressing, DHCP.
Network Devices: Repeater, hub, switch, router and gateway.

Unit-III

Routing Algorithms: Introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State and Distance Vector Routing.
Transport Layer: Transport layer functions and services, Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management.
Application Layer: Application layer functions and services, Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP.

Unit-IV

Congestion Control, Quality of Service, QoS parameters and QoS Improving techniques.
LAN and Wireless Networks: Ethernet, Wireless LAN (IEEE 802.11), Wi-Fi architecture, Token Bus, Token Ring, MAN Architecture- DQDB, WAN Architectures- Frame Relay, ATM, SONET/SDH
Network Security: Firewalls, security goals, types of attack, Introduction to cryptography, Types of ciphers: symmetric and asymmetric key ciphers.

Suggested Readings:

1. Data Communication and Networking by Behrouz A. Forouzan, 4th Edition, McGraw-Hill.
2. Data and Computer Communication by William Stallings, 8th Edition, Pearson Prentice Hall India.
3. Computer Networks by Andrew S. Tanenbaum, 8th Edition, Pearson New International Edition.
4. Internetworking with TCP/IP by Douglas Comer, Volume 1, 6th Edition, Prentice Hall of India.
5. TCP/IP Illustrated by W. Richard Stevens, Volume 1, Addison-Wesley, United States of America.

Useful Video Links

Unit No.	Topics	Links
Unit-I	Introduction to Computer Networks	https://www.youtube.com/watch?v=lnU-Zw3NEEQ
	OSI Model and TCP/IP Model	https://youtu.be/zzXs0EnCin0
	Packet Switching and Circuit Switching	https://youtu.be/29Qdz0FmvmQ?si=Yedvul4uJzmfkDsh
Unit-II	Medium Access Control Protocols	https://youtu.be/sx0UPzztC5o?si=VDg2wx1B68gvenjU
	Network Layer Introduction	https://youtu.be/aP346youQOk?si=6DRTU5dc1t21Dk_D
Unit-III	Routing Algorithms	https://youtu.be/AmlOSGYkKXc?si=87eNMi6RPeTd0FkL
	Transport Layer – TCP and UDP	https://youtu.be/EqzDTO9tdqs?si=16VZZu9Oz3IzOeOA
Unit-IV	Congestion Control and QoS	https://nptel.ac.in/courses/106105081
	SDH/SONET Layering, Frame Structure	https://youtu.be/f5EmFoXlYyQ?si=8ilxCANj5flH7TP4

Course code	**CSE-303A**				
Category	Professional Core Courses				
Course title	**Formal Languages and Automata**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of automata, formal languages, grammars, and computational models. • To develop understanding of language recognition, parsing, and computational mechanisms. • To enable application of automata and grammar concepts for problem solving. • To develop analytical abilities related to computability, decidability, and complexity.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the concepts, models, grammars, languages, and computational theories related to formal languages and automata.	Level 1: Remember
CO2	Explain the principles, operations, and relationships among automata, grammars, languages, and computational models.	Level 2: Understand
CO3	Apply automata, grammars, and computational models to solve language recognition and processing problems.	Level 3: Apply
CO4	Analyze computational models, language classes, and decidability issues to evaluate computational problems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Nondeterministic finite automata (NDFA), Equivalence of DFA and NDFA, Conversion of NFA to DFA , minimization of finite automata, Finite automata with ϵ- moves, Acceptability of a string by a finite Automata.
Introduction to Machines: Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

Unit-II

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of regular expression, Regular expression conversion to Finite Automata and vice versa.

Properties of regular languages: Regular language, pumping lemma for regular sets/languages, Application of regular languages.

Unit-III

Grammars: Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal, Reduced Forms: Removal of useless symbols, null and unit productions.

Normal Form: Chomsky Normal form(CNF) and Greibach Normal Form(GNF), Push Down Automata: Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

Unit-IV

Turing machines: The basic model for Turing machines (TM), Deterministic and NonDeterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by designed turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Suggested Readings:

1. Theory of Computer Science: Automata, Languages and Computation by K. L. P. Mishra and N. Chandrashekaran, 2nd Edition, Prentice Hall of India, India, 2003.
2. Fundamentals of the Theory of Computation: Principles and Practice by Raymond Greenlaw and H. James Hoover, Morgan Kaufmann, 1998.
3. Introduction to Languages and Automata Theory by John C. Martin, 3rd Edition, Tata McGraw-Hill, 2007.
4. Introduction to Automata Theory, Languages, and Computation by John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, 3rd Edition, Pearson Education.

Useful Video Link

Unit No	Topics	Links
Unit-I	Introduction to Automata, Languages and Computation	https://www.youtube.com/watch?v=_2w9UX17m_k&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=1
	Deterministic Finite Automata (DFA)	https://www.youtube.com/watch?v=CwihAY_fgRE&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=2
Unit-II	Regular expression	https://www.youtube.com/watch?v=OA8EY3HKZoc&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=17
	Pumping Lemma	https://www.youtube.com/watch?v=wQbdjmINxNU&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=28
Unit-III	Chomsky Normal Form (CNF)	https://www.youtube.com/watch?v=AnHE1jVpgHA&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=47
Unit-IV	Turning Machine	https://www.youtube.com/watch?v=WYncdAzKMHU&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=60

Course Code	**CSE-305A**				
Category	Professional Core Courses				
Course Title	**Design and Analysis of Algorithms**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of algorithm design techniques and complexity analysis. • To develop understanding of algorithmic paradigms and optimization methods. • To enable application of algorithms for solving computational problems. • To develop analytical skills for evaluating algorithm efficiency and complexity.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define algorithm design concepts, complexity measures, design paradigms, and computational problem classes.	Level 1: Remember
CO2	Explain algorithmic strategies, optimization techniques, and complexity concepts used in problem solving.	Level 2: Understand
CO3	Apply appropriate algorithm design techniques to solve computational and optimization problems.	Level 3: Apply
CO4	Analyze algorithms and computational problems based on correctness, efficiency, and complexity.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Algorithms: Algorithm, Performance Analysis (Time and Space complexity), Asymptotic Notation (Big OH, Omega and Theta)-best, average and worst-case behaviour.
Divide and Conquer: General method, Binary Search, Merge Sort, Quick Sort, and other sorting algorithms with divide and conquer strategy, Strassen's Matrix Multiplication algorithms.

Unit-II

Greedy Method: General method, Fractional Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Single source shortest paths.
Dynamic Programming: General method, Optimal Binary Search Trees, 0/1 knapsack, The Travelling Salesperson problem.

Unit-III

Back Tracking: General method, The 8-Queen's problem, Sum of subsets, Graph Colouring, Hamiltonian Cycles. Branch and Bound: The method, 0/1 knapsack problem, Travelling Salesperson problem, Efficiency considerations.

Unit-IV

NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph problems, NP hard scheduling problems, NP hard code generation problems, and Some simplified NP hard problems.

Suggested Readings:

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publication.
2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald Lrivest: 1990, TMH.
3. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E ., 1974, Addison Wesley.
4. Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetnieni, 1997, MGH.

Useful Video links:

Unit No.	Topic	Link
Unit-I	Asymptotic Notation	https://youtu.be/EL9T1ngiCqA?si=oaMBKNhfiIOODUlM
	Divide and Conquer Paradigm	https://youtu.be/xdD0nIWe0wA?si=P3DQs80dHBg3-aiM
Unit-II	Minimum Cost Spanning Tree	https://youtu.be/k9jemw3SZe0?si=93sq4N5-AjF-oVhy
	Knapsack Problem	https://youtu.be/-Cg-aL1D8CM?si=MSMQTKSaPqcNuZME
Unit-III	Sum of subsets	https://youtu.be/yDjadhjQ3eE?si=-6NQH4xIHYqemNp6
	Traveling Salesman Problem	https://youtu.be/-cLsEHP0qt0?si=-asPYE1zbCTMokLK
Unit-IV	Cook's theorem	https://youtu.be/qpCvPS-WwGA?si=CswYDncPrmCi3b_W
	NP Complete Problems	https://youtu.be/id7k6gUkZ8Y?si=fCSY5t-XMgUKzPi1

Course code	**CSE-307A**				
Category	Professional Core Courses				
Course title	**Programming in Java**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To provide knowledge of Java programming concepts, syntax, and execution environment. • To develop understanding of object-oriented programming and Java application development. • To enable application of Java programming techniques for software development. • To develop analytical skills for designing and evaluating Java-based solutions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define Java programming concepts, object-oriented principles, language constructs, and application development components.	Level 1: Remember
CO2	Explain Java programming features, object-oriented concepts, multithreading, GUI development, and advanced programming techniques.	Level 2: Understand
CO3	Apply Java programming concepts, libraries, and tools to develop software applications.	Level 3: Apply
CO4	Analyze Java-based solutions using object-oriented design principles, advanced programming features, and database connectivity techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Java: Evolution and features of Java, OOP concepts and Java program structure, JVM, JRE and JDK, Java compilation and execution process, Platform independence, portability and security, JAR files and naming conventions, Data types, type casting and operators, Control statements and loops, Arrays and command line arguments, JVM security architecture and sandbox model.

Unit-II

OOPS Implementation: Classes, objects, methods, constructors, encapsulation, reference variables, method overloading and method overriding, static members and blocks, Memory structure (Stack, Heap, Method Area), Class loading and execution flow, Argument passing and wrapper classes, this and super keywords, constructor chaining, Inheritance, polymorphism, abstraction, abstract classes, final keyword, interfaces, aggregation and composition, inner and anonymous classes, String class, String Buffer and String Builder classes, tokenizer and applets.

Unit-III

Threads, Swing & AWT, Packages and Exception Handling: Thread creation and lifecycle, thread synchronization and communication using wait(), notify() and notifyAll(). Multithreading concepts, Swing and AWT components, containers, layout managers and event handling, Mouse and keyboard events. Packages, class path and access modifiers. Exception handling, try-catch-finally, throw and throws keywords, checked and unchecked exceptions, user-defined exceptions, File handling basics.

Unit-IV

Collection Framework, JDBC and Advanced Java: List, Set, Map, Queue, Iterators and Generics, Comparable and Comparator interfaces, Collections utility class and Properties handling, JDBC architecture and drivers, CRUD operations, Prepared Statement and Callable Statement, transactions and batch processing, Result Set and metadata, Input/Output streams, buffered streams, serialization and deserialization, file handling, Reflection API, new Instance(), javap tool, lambda expressions and introduction to Java 8/9 features.

Suggested Readings:

1. Java2 the complete Reference by Patrick Naughton and Herbert Schildt, TMH.
2. Head First Java by Sierra & bates, O'Reilly.
3. Programming with Java by E. Balaguruswamy, TMH.
4. Computing Concepts with Java 2 Essentials by Horstmann, John Wiley.
5. Programming. Java by Decker & Hirshfield, Brooks/Cole.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to java	https://www.youtube.com/watch?v=OjdT
	OOP Concepts and Java Program Structure	https://www.youtube.com/watch?v=Qg3HDbmbW6I
Unit-II	Abstract classes,	https://www.youtube.com/watch?v=qgBv1_Plldo
	Inheritance	https://www.youtube.com/watch?v=rxsl1TzcEgg
Unit-III	Swing—I	https://www.youtube.com/watch?v=mQj34vU
	Multithreading-I	https://www.youtube.com/watch?v=6rYOyIGfy3w
Unit-IV	JDBC—I	https://www.youtube.com/watch?v=ajhWv31oN1k&lis
	JDBC—II	https://www.youtube.com/watch?v=v5vLuC

Course Code	**ECE-001A**				
Category	Engineering Science Courses				
Course Title	**Microprocessor and Microcontroller**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand the architecture and instruction set of microprocessors (8086, x86) and microcontrollers (8051, ARM). ● To develop low-level programming skills using assembly language. ● To learn peripheral interfacing concepts such as timers, I/O ports, ADC/DAC, and communication protocols. ● To explore advanced processors and embedded system using ARM Architecture.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Describe the features and architecture of Intel processors and microcontrollers for signal descriptions and system design.
CO2	Use addressing modes and instructions of microprocessors and microcontrollers to write simple and efficient assembly programs.
CO3	Classify the interrupts and modes of operation in microprocessors and microcontrollers and analyze their impact on system performance and functionality.
CO4	Apply appropriate data transfer schemes and hardware for transfer data between the of peripheral devices for interfacing I/O devices.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Microprocessors and Programming: Introduction to Microprocessors: Evolution, 8-bit/16-bit (8085/8086), Architecture, Pin configuration, Addressing modes and register organization of 8085.
8086 Architecture: Pin configuration, Register organization, Addressing Modes, Memory Segmentation, Instruction Set of 8086, Minimum/Maximum Mode, Assembly language programming of 8086.

Unit-II

Microprocessor Interfacing Overview of Intel Pentium family processor, Overview of Multi-core Processors and Mobile Processor, Memory Interfacing, Peripheral Interfacing (8255 PPI, 8254 Timer, 8237 DMA, 8259 PIC), Concepts of Interrupts and DMA.
Memory Concepts: Cache Memory, Virtual Memory – Mapping and Access Mechanisms.

Unit-III

8051 Microcontroller and Interfacing: 8051 Architecture: RAM/ROM layout, machine cycle, I/O structure, Instruction Set: Addressing Modes, Data Transfer, Arithmetic, Logical, Branching, Assembly Language Programming. Peripherals and Interfacing: Timers/Counters, Serial Communication, Interrupts, ADC, DAC, LCD, LED, Keypad.

Unit-IV

ARM Processor Architecture and Instruction set: RISC vs. CISC, ARM Design Philosophy, ARM Architecture: States (ARM, Thumb, Jazelle), Register, Sets, Modes, Pipelining ARM Instruction Set: Data Processing, Load/Store, Branch, Conditional Execution, SWI, Vector Tables, Exception Handling.

Suggested Readings:

1. Microprocessors and interfacing by D. V. Hall,, TMH, 2nd Edition.
2. Microprocessor 8086: Architecture, Programming and Interfacing by Sunil Mathur, PHI Publisher.
3. Microprocessors and Microcontrollers by Sunil Mathur, Jeebananda Panda, PHI Publisher.
4. Advanced Microprocessors and Peripherals Architectures, Programming and Interfacing by Ray A. K. and Burchandi, TMH.
5. The Intel Microprocessors 8086- Pentium Processor by Brey, 8th Edition, Pearson Education.
6. The X86 PC: Assembly Language, Design and interfacing by M. A. Mazidi, J. P. Maizidi and Danny Causey, 5th Edition, Pearson Education.
7. Microcontrollers: Architectures, Programming, Interfacing and System Design by Raj Kamal, Pearson Education.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Microprocessors and Interfacing – NPTEL Focuses on the interfacing aspects of microprocessors, covering essential concepts and practical applications	https://www.youtube.com/playlist?list=PLdlPA9pGVVtaUwRP-2Eaux10vo_USuDy1
	Microprocessors & Microcontrollers by Prof. Sunil Mathur	https://www.youtube.com/@profsunilmathur8809
Unit-II	Advanced Microprocessors and Memory Systems	https://www.youtube.com/playlist?list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3
Unit-III	8051 Microcontroller and Interfacing ,The 8051 Microcontroller and Embedded Systems by Prof. Santanu Chattopadhyay (IIT Kharagpur)	https://www.youtube.com/playlist?list=PLEPI1RnS5drMCNu1VPDwdrRO_U0awwTxJ
Unit-IV	ARM Processor Architecture and Embedded Design, Embedded System Design with ARM by Prof. Dhananjay V. Gadre (IIT Delhi). Focuses on ARM architecture and its application in embedded system design, offering practical insights and examples.	https://www.youtube.com/playlist?list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU

Course Code	**CSE-L301A**				
Category	Professional Core Courses				
Course Title	**Computer Networks Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To provide practical knowledge of network cabling, network devices, IP addressing, and LAN connectivity. • To develop skills in configuring and troubleshooting network devices and network communication using networking commands and tools. • To enable students to design and configure network topologies, routing protocols, and NAT using Packet Tracer and Cisco IOS commands. • To develop the ability to analyze network connectivity, routing behavior, and network performance using diagnostic and simulation tools.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the operation of network cables, network devices, IP addressing, and basic networking commands used in computer networks.	Level 2: Understand
CO2	Configure LAN connectivity, network devices, and basic network parameters using networking tools and commands.	Level 3: Apply
CO3	Apply Packet Tracer and Cisco IOS commands to implement network topologies, NAT, and routing protocols.	Level 3: Apply
CO4	Analyze network connectivity, routing behavior, and troubleshooting results using ping, traceroute, and network configuration tools.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.	CO1
2	Study of Network Devices in Detail.	CO2
3	Study of network IP.	CO2
4	Connect the computers in Local Area Network.	CO2
5	Study of basic network command and Network configuration commands.	CO2
6	Configure a Network topology using packet tracer software.	CO3

7	Performing an Initial Switch Configuration.	CO4
8	Using the Cisco IOS Show Commands.	CO3
9	Interpreting Ping and Traceroute Output.	CO3
10	Examining Network Address Translation (NAT).	CO3
11	Configure a Network using Distance Vector Routing protocol.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Study of Network Cables	https://www.netacad.com/learning-collections/cisco-packet-tracer
Configure a Network topology using packet tracer software.	https://cn-iitr.vlabs.ac.in/exp/network-topologies/
Dynamic Routing Protocols	https://cn-iitr.vlabs.ac.in/exp/dynamic-routing/simulation.html

Course Code	**CSE-L305A**				
Category	Professional Core Courses				
Course Title	**Design and Analysis of Algorithms Lab Using C++**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop understanding of algorithm design techniques and complexity analysis. • To provide practical exposure to sorting and graph algorithms. • To develop skills in greedy, dynamic programming, and backtracking techniques. • To develop analytical skills for evaluating algorithm performance.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain algorithm design techniques and complexity concepts.	Level 2: Understand
CO2	Apply divide-and-conquer and graph algorithms to computational problems.	Level 3: Apply
CO3	Apply greedy, dynamic programming, and backtracking techniques to optimization problems.	Level 3: Apply
CO4	Compare the performance of selected algorithms for computational problems.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Study the basic concepts of algorithm design and analysis of algorithms.	CO1
2	Write a C++ Program to perform Quick Sort using Divide & Conquer Technique.	CO2
3	Write a C++ program to perform Merge Sort using Divide and Conquer technique and compare its performance with Quick Sort for different input sizes.	CO2 CO4
4	Write a C++ program to find all-pairs shortest paths using the Floyd–Warshall algorithm and compare its performance with Dijkstra's algorithm for suitable graphs.	CO2 CO4
5	Write a C++ Program to solve the Knapsack Problem using Greedy Approach.	CO3
6	Write a C++ Program for Shortest Path using Dijkstra's Algorithm.	CO2
7	Write a C++ Program to find Minimum Spanning Tree using Prim's Algorithm.	CO2
8	Write a C++ Program for Sum of Subsets Problem using Back Tracking.	CO3

9	Write a C++ Program to solve Travelling Sales Problem using the Dynamic Programming Approach.	CO3
10	Write a C++ program to solve the N-Queen Problem using Backtracking and analyze the effect of increasing board size on execution time.	CO3 CO4
11	Write a Program to Check whether a given graph is connected or not using DFS method.	CO2

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Write a C++ Program to perform Quick Sort using Divide & Conquer Technique.	https://ds1-iiith.vlabs.ac.in/exp/quick-sort/quick-sort/index.html
Write a C++ Program for Shortest Path using Dijkstra's Algorithm.	https://ds2-iiith.vlabs.ac.in/exp/dijkstra-algorithm/index.html
Write a C++ Program to find Minimum Spanning Tree using Prim's Algorithm.	https://ds2-iiith.vlabs.ac.in/exp/min-spanning-trees/index.html

Course Code	**CSE-L307A**				
Category	Professional Core Courses				
Course Title	**Programming in Java Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: ● To understand Java programming fundamentals and object-oriented concepts. ● To develop Java applications using core language features and programming constructs. ● To implement GUI, multithreading, exception handling, and file processing techniques. ● To apply Java collections and JDBC for software and database application development.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain Java programming concepts, object-oriented principles, and application development techniques.	Level 1: Remember
CO2	Apply Java language features and programming constructs to develop applications.	Level 2: Understand
CO3	Develop Java applications using GUI programming, multithreading, collections, and JDBC.	Level 3: Apply
CO4	Analyze Java-based solutions using object-oriented design and advanced programming techniques.	Level 4: Analyze

List of Experiments:

S. No.	**Content**	**COs**
1	Study the Basic concepts and features of Java programming language.	CO1
2	Write a program to demonstrate Java Fundamentals, OOP Concepts, Classes, Objects and Basic Program Execution	CO2
3	Write the program in java to print “Hello World”!	CO2
4	Write a program to demonstrate Java Fundamentals, JVM, JRE, JDK, data types, operators, control statements and basic program execution.	CO2
5	Write a program in Java to perform arithmetic operations, type casting and command line argument handling.	CO2

6	Write a program in Java to perform arithmetic operations, type casting and command line argument handling.	CO2
7	Write a program in Java to perform Abstract Classes, Interfaces and String handling using String, StringBuffer and StringBuilder.	CO2
8	Write a program in Java to create multithreading applications using Thread class, Runnable interface and synchronization.	CO3
9	Write a program in Java to design GUI applications using AWT/Applet components and event handling.	CO3
10	Write a program in Java to develop a scientific calculator using Swing components and layout managers.	CO3
11	Write a program in Java to demonstrate Exception Handling, User Defined Exceptions and File Handling operations.	CO4
12	Write a program in Java to implement Collection Framework, JDBC connectivity and CRUD operations using database applications.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Write a program to demonstrate Java Fundamentals, OOP Concepts, Classes, Objects and Basic Program Execution	https://java-iitd.vlabs.ac.in/exp/classes-objects/simulation.html
Write the program in java to Additions, Subtraction, Multiplication & Division of Two values.	https://www.youtube.com/watch?v=4OFg5sQQics

Course Code	**ECE-L001A**				
Category	Engineering Science Courses				
Course Title	**Microprocessor and Microcontroller Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	0	0	2	1	
Course Objectives	The objectives of this course are • To understand architecture and working of Microprocessor and Microcontroller. • To learn assembly programming for arithmetic and data operations. • To provide hands-on experience in interfacing various peripherals with processor based systems.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Explain the architecture and functioning of microprocessors and microcontroller using model kits and instruction sets.
CO2	Develop and debug assembly language programs for arithmetic, logical and data manipulation tasks using instruction sets.
CO3	Apply interfacing techniques to connect peripherals with computing devices for practical applications.
CO4	Analyze embedded control algorithms for hardware interfacing and timing operations using microcontroller kit.

List of Experiments:

S. No.	**Content**
1	To study the architecture and functional blocks of the 8085 and 8086 microprocessors using trainer kit.
2	Write and execute program to perform arithmetic operations such as addition, subtraction, multiplication and division using 8085 instruction set.
3	Write a program to add the content of the memory location to the content of other memory location and store the result in 3rd memory location using 8086 instruction set.
4	Write a program to add 16 bit number using 8086 instruction set.
5	Write a program for multiplication of two 16 bit numbers using 8086 instruction set.
6	Write a program for division of two 16 bit numbers using 8086 instruction set.
7	Write a program to calculate the factorial of a given number using the 8086 instruction set.
8	Write a program to find the average of two given numbers using the 8086 instruction set.

9	Write a program to find the largest number in a data array using 8086 Instruction set.
10	Write and execute an 8086 assembly language program to interface and control a stepper motor using the 8255 (PPI).
11	To study the architecture and functioning of the 8051 microcontroller using trainer kit.
12	Write and execute a program to generate a square wave using the 8051 microcontroller.
13	Write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Introduction of Microprocessor 8085 Trainer Kit. Introduction of Microprocessor 8086 Trainer Kit	https://www.youtube.com/watch?v=GsPxk6GYf2Y&list=PLbEc0iDORYCp1yLvEfNxbZOZ4lTPUv_4f https://www.youtube.com/watch?v=GZibA34SU0c
2	Write a program to find the average of two given numbers using the 8086 instruction set.	https://www.youtube.com/watch?v=nOt9Wa-ClRo&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=10
3	Write a program to find the largest number in a data array using 8086 Instruction set.	https://www.youtube.com/watch?v=vNRGKG8ujVc&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=12
4	Write a program to calculate the factorial of a given number using the 8086 instruction set..	https://www.youtube.com/watch?v=riliLJP0Q_0&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=13
5	To write and execute an 8086 assembly language program to interface a stepper motor using 8255 PPI and control its rotation.	https://www.youtube.com/watch?v=lj5L1nGZAwg
6	To write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.	https://www.youtube.com/watch?v=aGVn4xGrAfY

<table>
<tr><td>Course Code</td><td colspan="5">PT-301A</td></tr>
<tr><td>Category</td><td colspan="5">Practical Training</td></tr>
<tr><td>Course Title</td><td colspan="5">Practical Training-I*</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are to
Develop practical skills using industry-standard software tools and technologies.
Apply software engineering practices and technical documentation in real-world projects.
Enhance professional communication, teamwork, time management, and ethical practices.
Analyze and solve real-world computing problems using appropriate tools and methodologies.</td></tr>
<tr><td>Assessment</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain industry practices, coding standards, and software development processes.	Level 2: Understand
CO2	Apply computing knowledge and programming skills to solve practical problems.	Level 3: Apply
CO3	Demonstrate effective communication, teamwork, professional ethics, and time management.	Level 3: Apply
CO4	Analyze real-world computing problems and formulate appropriate solutions using collaborative and systematic approaches.	Level 4: Analyze
CO5	Evaluate the application of theoretical concepts, modern technologies, and innovative methodologies to solve practical computing challenges.	Level 5: Evaluate
CO6	Utilize industry-standard tools, frameworks, platforms, and development methodologies for the design, implementation, testing, and deployment of software solutions.	Level 6: Create

Note:

1. Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the V semester.
2. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

<table>
<tr><td>Course Code</td><td colspan="5">CSE-309A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Distributed Systems</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To provide knowledge of distributed system architectures, communication models, and design issues.
● To develop understanding of synchronization, resource management, and distributed services.
● To enable application of distributed computing techniques for system implementation.
● To develop analytical abilities related to performance, reliability, and security of distributed systems.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define the concepts, architectures, communication mechanisms, services, and security aspects of distributed systems.	Level 1: Remember
CO2	Explain the principles, models, synchronization techniques, resource management methods, and services used in distributed systems.	Level 2: Understand
CO3	Apply distributed system concepts, communication mechanisms, and resource management techniques to solve computing problems.	Level 3: Apply
CO4	Analyze distributed systems based on performance, reliability, scalability, fault tolerance, and security requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Distributed Operating Systems Definition and goals, Hardware and Software concepts, Design issues.
Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC

Unit-II

Synchronization in Distributed System: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems.
Processes and processors in Distributed systems: Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, real time distributed systems, Process migration and related issues.

Unit-III

Distributed File systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study.
Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing.

Unit-IV

Security Issues: Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management.
Distributed Web-based Systems: Architecture, Processes, Communication, Naming, and Synchronization.
Case Studies: JAVA RMI, Sun Network File System, Google Case Study.

Suggested Readings:

1. Distributed Operating Systems by Andrew S Tanenbaum, Pearson.
2. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI.
3. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore, Tim Kindberg, Pearson.
4. Distributed Computing by Sunita Mahajan & Seema Shah OXFORD.
5. Distributed Systems: Principles and Paradigms by Andrew S Tanebaum, Maarten Van Steen, PHI.
6. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, Hagit Attiya and Jennifer Welch, Wiley India.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Distributed Systems	https://onlinecourses.nptel.ac.in/noc25_cs130/preview
	Remote Procedure Call/Message Passing Concepts	https://freevideolectures.com/course/4596/nptel-distributed-systems/5
Unit-II	Clock Synchronization	https://www.youtube.com/watch?v=6rtGYTuJn9k
	Distributed Mutual Exclusion	https://onlinecourses-archive.nptel.ac.in/noc17_cs42/preview
Unit-III	Distributed Shared Memory (DSM)	https://onlinecourses-archive.nptel.ac.in/noc17_cs42
	Google File System / Distributed File Systems	https://onlinecourses.nptel.ac.in/noc25_cs130/preview
Unit-IV	Security in Distributed Systems	https://onlinecourses.nptel.ac.in/noc25_cs130/preview
	Cloud Computing & Distributed Web Systems	https://onlinecourses.nptel.ac.in/noc22_cs18/preview

Course code	**CSE-311A**				
Category	Professional Elective Courses				
Course title	**Advanced Computer Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce advanced computer architecture concepts. ● To familiarize students with advanced memory hierarchy techniques. ● To provide knowledge of parallel and multiprocessor architectures. ● To develop understanding of modern performance-enhancement techniques in computing				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define concepts and terminology of advanced computer architecture.	Level 1: Remember
CO2	Explain the principles of processor performance, instruction-level parallelism, memory organization, and multiprocessor architectures.	Level 2: Understand
CO3	Apply advanced computer architecture concepts to computing systems.	Level 3 : Apply
CO4	Analyze architectural techniques and performance trade-offs in modern computing systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Processor Performance and Instruction-Level Parallelism: Review of Processor Performance Metrics, CPU Performance Equation, Amdahl's Law, Performance Benchmarking, Instruction-Level Parallelism (ILP), Data, Structural and Control Hazards, Pipeline Optimization Techniques, Branch Prediction, Speculative Execution.
Superscalar Architecture: Multiple-Issue Processors, Dynamic Scheduling, Register Renaming, Out-of-Order Execution, Reorder Buffer and Precise Exceptions.

Unit-II

Advanced Memory Hierarchy: Memory Hierarchy Design, Cache Performance Metrics, Multi-Level Cache Organization, Inclusive and Exclusive Caches, Cache Optimization Techniques, Prefetching Methods, Victim Cache.
Virtual Memory Systems, Translation Lookaside Buffer (TLB), Virtual-to-Physical Address Translation, Memory Protection Mechanisms, Memory Consistency Models.

Unit-III

Multicore and Parallel Architectures: Introduction to Parallel Computing, Flynn's Classification, Shared Memory and Distributed Memory Architectures, Multicore Processors, Simultaneous Multithreading (SMT), Chip Multiprocessors (CMP).
Vector Processors and SIMD Architectures, Introduction to General-Purpose GPU Computing (GPGPU), Comparison of CPU and GPU Architectures, Applications of Parallel Architectures.

Unit-IV

Multiprocessor Systems and Emerging Architectures: Shared Memory Multiprocessors, Interconnection Networks, Synchronization Mechanisms, Cache Coherence Problem, Snooping and Directory-Based Coherence Protocols, MESI Protocol.
NUMA Architectures, Manycore Systems, Heterogeneous Computing Architectures, Architecture Trends for Artificial Intelligence, Cloud Computing and High-Performance Computing Systems.

Suggested Readings:

1. Computer Architecture: A Quantitative Approach by John L. Hennessy and David A. Patterson, 6th Edition, Morgan Kaufmann Publishers, USA, 2017.
2. Computer Organization and Architecture: Designing for Performance by William Stallings, 11th Edition, Pearson Education, United Kingdom, 2019.
3. Advanced Computer Architecture: Parallelism, Scalability, Programmability by Kai Hwang, Naresh Jotwani and Hsiao H. Wang, 3rd Edition, McGraw-Hill Education, India, 2015.
4. Structured Computer Organization by Andrew S. Tanenbaum and Todd Austin, 6th Edition, Pearson Education, USA, 2013.
5. Computer System Architecture by M. Morris Mano, 3rd Edition, Pearson Education, India, 2007.
6. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

Useful Video Links:

Unit	Topic	NPTEL Video Lecture Link
Unit-I	Processor Performance and Benchmarking	https://youtu.be/H4oSQZIBkNY?si=ir7y01X1rsADDU8I
	Pipeline Hazards and Branch Prediction	https://youtu.be/Gp2cwH740O0?si=NXNjjg-7Ig-o7h0n
	Superscalar Processors	https://youtu.be/0Ce22P_jeLQ?si=HB0YSigienbFtK6P
Unit-II	Memory Hierarchy	https://youtu.be/__Cs4PWT3fs?si=ezFLd9HzYL5J4RnM
	Multi-Level Cache Organization	https://youtu.be/dkquNQNaXxg?si=aX_P2Ybg-92VoVqA
	Virtual Memory	https://youtu.be/Ev4BET3i5R0?si=-5EGwNEZimxafagm
Unit-III	Multicore Processors	https://youtu.be/nF3kr5KvUno?si=jFPHp_GWR5rmOwXZ
	GPU Architecture Fundamentals	https://youtu.be/GOam2jFb700?si=kn50mvslNcg4jEvK
Unit-IV	Cache Coherence Protocols	https://youtu.be/zxHxgB07Yn8?si=RlycvUZ-u55AOR3u
	Snooping and Directory-Based Protocols	https://youtu.be/wOEV6Oy3A64?si=QL4Ib2JksX9mIH9e

Course Code	**CSE-313A**				
Category	Professional Elective Courses				
Course Title	**Computer Graphics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are ● To provide knowledge of computer graphics principles, transformations, and viewing techniques. ● To develop understanding of graphical representations, rendering, and visualization methods. ● To enable application of graphics techniques for modeling and image generation. ● To develop analytical skills related to graphical algorithms and visualization techniques.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define computer graphics concepts, graphical primitives, transformations, viewing techniques, and rendering methods.	Level 1: Remember
CO2	Explain graphical representations, transformation processes, viewing mechanisms, and rendering techniques.	Level 2: Understand
CO3	Apply computer graphics algorithms and techniques for modeling, transformation, visualization, and image generation.	Level 3: Apply
CO4	Analyze graphical models, rendering methods, visualization techniques, and image processing approaches.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Refresh CRT, Color CRT Monitors, LCD, Two-dimensional Graphics Primitives: Points and Lines, Scan Conversion: Point, Line, Circle; Region Filling: Scanline algorithm, Polygon filling algorithm, boundary filled algorithm, DDA Algorithm, Bresenham Algorithm.

Unit-II

Two-dimensional transformations: Geometric, Coordinate and, composite transformation. Two-Dimensional Viewing: window to view port mapping; Clipping: point, line, polygon, curve and text clipping, Homogeneous Coordinates and matrix representation of 2d transformation.

Unit-III

Three-dimensional transformations: Three-dimensional graphics concept, Geometric and Coordinate transformations, Viewing in 3D: Projection, Taxonomy of projection, Hidden surface removal: Introduction to hidden surface removal, The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.

Unit-IV

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, BSpline curves. Parametric representation of surfaces; Interpolation method. Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency, image processing.

Suggested Readings:

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2 Edition, 1999, PHI
3. Computer Graphics by Z. Xiang, R. Plastock, 2nd Edition, TMH Education.

Useful Video Links:

Unit	Topic Name	Link
Unit-I	Introduction to Computer Graphics	https://youtu.be/NmMky9Pg8Yc?si=iSIGpSitxssO39FN
	Region Filling	https://youtu.be/TNbkX5bYrtE?si=Cvkg1exdIzl9GL0n
Unit-II	Two-dimensional transformations	https://youtu.be/lNYhWBPEeaY?si=lFi1URIAlDrp41aB
	Two-Dimensional Viewing	https://youtu.be/JPADSZzY-ko?si=X7OrdpEhtF9yS9po
Unit-III	Three-dimensional transformations	https://youtu.be/I8o4kK9QRL4?si=5fBczLrRdqQZIxYJ
	The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.	https://youtu.be/b1Qpvqm0UAo?si=2wDTVIN23b7gccal
Unit-IV	Representing Curves and Surfaces	https://youtu.be/OkncKzflw8I?si=inLgPagikbEkzB81
	Image manipulation	https://youtu.be/JD9O6e8Q0Xw?si=cff2gyNh7OSL7f_5

<table>
<tr><td>Course Code</td><td colspan="5">CSE-315A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Data Warehouse and Mining</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To introduce the fundamentals of data warehousing and data mining.
● To provide knowledge of data mining techniques for pattern discovery and classification.
● To familiarize students with clustering methods and web data mining concepts.
● To develop understanding of techniques and tools for knowledge discovery from large datasets.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define concepts and terminology related to data warehousing and data mining.	Level 1: Remember
CO2	Explain data mining techniques, algorithms, and knowledge discovery processes.	Level 2: Understand
CO3	Apply data warehousing and data mining methods to extract useful patterns from data.	Level 3: Apply
CO4	Analyze data mining models, clustering techniques, and web mining approaches for knowledge discovery.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Data warehousing: Introduction, Operational data stores, ETL, Data warehouses – design guidelines for data warehouse implementation, Data warehouse metadata; OLAP – introduction, Characteristics, Multidimensional view and data cube, Data cube operations.

Unit-II

Data mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation(FP, growth), performance evaluation of algorithms.

Unit-III

Classification: Introduction, decision tree, tree induction algorithm – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method; classification software, software for association rule mining; case study; KDD Insurance Risk Assessment.

Unit-IV

Cluster analysis: Introduction, partitional methods, hierarchical methods, and density based methods, dealing with large databases, cluster software.
Web Data Mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

Suggested Readings:

1. Data mining concepts and techniques by Han J., Kamber M. and Pei J., Morgan Kaufmann Publishers (2011) 3rd ed.
2. Data Mining by Pudi V., Krishana P.R., Oxford University press, (2009) 1st ed.
3. Data mining by Adriaans P., Zantinge D., Pearson education press (1996), 1st ed.
4. Data Warehousing Fundamentals by Pooniah, Willey interscience Publication, (2001), 1st ed.

Useful Video links

Unit No	Topics	Links
Unit-I	Introduction, Knowledge Discovery Process	https://www.youtubeeducation.com/watch?v=ykZ-_UGcYWg
	OLAP	https://youtu.be/m-aKj5ovDfg?si=1IqwlHoN5T4VWfPK
Unit-II	Classification	https://www.youtubeeducation.com/watch?v=VsYKqOokgaE
	Apriori algorithm	https://youtu.be/hEQkqpmtx-Y?si=hMDJ-3cvDvx_PIur
Unit-III	Bayes Classifier	https://www.youtubeeducation.com/watch?v=DXnnvprUl2Y
	Decision Tree	https://www.youtubeeducation.com/watch?v=4l4_BREP6ZI
Unit-IV	Cluster analysis	https://www.youtubeeducation.com/watch?v=VcPWL9Nlozs
	Density based methods	https://youtu.be/E_SdiZQ23xI?si=hupzFk1EjSNbge4q

<table>
<tr><td>Course Code</td><td colspan="5">AI-301A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Machine Learning</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of machine learning concepts, techniques, and applications.
To develop understanding of data preprocessing, feature engineering, and dimensionality reduction methods.
To enable application of machine learning algorithms for prediction and pattern discovery.
To develop analytical skills for evaluating and improving machine learning models.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define machine learning concepts, learning paradigms, techniques, and applications.	Level 1: Remember
CO2	Explain data preprocessing, feature representation, dimensionality reduction, and learning methodologies.	Level 2: Understand
CO3	Apply machine learning algorithms to solve classification, prediction, and clustering problems.	Level 3: Apply
CO4	Analyze machine learning models using appropriate performance measures and evaluation techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Machine Learning: Definition, History, Need, Features, Block diagrammatic representation of learning machines, Classification of Machine Learning: Supervised learning, Unsupervised learning, Reinforcement Learning, Machine Learning life cycle, Applications of Machine Learning.

Unit-II

Dimensionality reduction: Definition, Row vector and Column vector, how to represent a dataset, how to represent a dataset as a Matrix, Data preprocessing in Machine Learning: Feature Normalization, Mean of a data matrix, Column Standardization, Co-variance of a Data Matrix, Principal Component Analysis for Dimensionality reduction.

Unit-III

Supervised Learning: Definition, how it works, Types of Supervised learning algorithms k - Nearest Neighbours, Naïve Bayes, Decision Trees, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines, Generalized Linear Models, Non-linearity and Kernel Methods**.**

Unit-IV

Unsupervised Learning: Clustering: K-means. Ensemble Methods: Boosting, Bagging, Random Forests.
Evaluation: Performance measurement of models in terms of accuracy, confusion matrix, precision & recall, F1-score, receiver Operating Characteristic Curve (ROC) curve and AUC, Median absolute deviation (MAD), Distribution of errors.

Suggested Readings:

1. Introduction to machine learning by E. Alpaydin.
2. The Elements of Statistical Learning Data Mining, Inference, and Prediction by T Hastie, R Tibshirani and J Friedman, 2nd Edition, Springer, 2009.
3. Pattern Recognition and Machine Learning by C. M. Bishop, Springer, 2010.
4. Pattern Classification by R. O. Duda, P. E. Hart, and D.G. Stork, John Wiley and Sons, 2012.
5. Networks and Learning Machines by Simon O. Haykin, Neural, Pearson Education, 2016.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Machine Learning	https://www.youtube.com/watch?v=r4sgKrRL2Ys&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77
	Supervised Learning	https://www.youtube.com/watch?v=OTAR0kT1swg&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=3
	Unsupervised Learning	https://www.youtube.com/watch?v=HTSCbxSxs-g&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=4
	Reinforcement Learning	https://www.youtube.com/watch?v=9vMpHk44XXo&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=5
Unit-II	Dimensionality Reduction: Principal Component Analysis (PCA) & kernel PCA	https://www.youtube.com/watch?v=YepECGlOl4Y
	Introduction to Data Preprocessing	https://www.youtube.com/watch?v=cO6lrQuepcs
Unit-III	Types of supervised learning	https://www.youtube.com/watch?v=5NSKURYzU70
	Linear Regression	https://www.youtube.com/watch?v=_M7Km1XZERU&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=9
	Logistic Regression	https://www.youtube.com/watch?v=g__LURKuIj4&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=17
Unit-IV	Unsupervised Learning & K-means Machine Learning for Engineering & Science Applications	https://www.youtube.com/watch?v=FeVrAK77mV8
	The ROC Curve	https://www.youtube.com/watch?v=6RjcFVm_k4c

Course Code	**CSE-001A**				
Category	Professional Core Courses				
Course Title	**Compiler Design**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are ● To provide knowledge of compiler organization, language processing, and translation techniques. ● To develop understanding of lexical, syntax, and semantic analysis methods. ● To enable application of compiler construction techniques for program translation. ● To develop analytical abilities related to code generation, optimization, and error handling.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define compiler components, language processing concepts, translation techniques and code generation mechanisms.	Level 1: Remember
CO2	Explain lexical analysis, syntax analysis, semantic processing and intermediate code generation techniques.	Level 2: Understand
CO3	Apply compiler design techniques for lexical processing, parsing, translation and code generation.	Level 3: Apply
CO4	Analyze compiler structures, optimization techniques, error handling methods and code generation strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Compilers: Language Processors, The Structure of compiler: its different phases, Compiler Construction Tools, Applications of Compiler Technology. Lexical Analysis: Role of lexical analyzer, Input Buffering, Specification and recognition of tokens, design of lexical analyzer, regular expressions, A language specifying lexical analyzer, Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing number of states of DFA, Implementation of lexical analyzer.

Unit-II

Syntax Analysis: Role of parsers, context free grammars, Parsing Technique: Bottom-up Parsing, Shift-reduce parsing, Operator precedence parsing, Top down parsing, Predictive parsing, Recursive Descent Parsing.

Unit-III

LR parsers: SLR, LALR and Canonical LR parser. Syntax Directed Translations: Syntax directed definitions, construction of syntax trees, syntax directed translation scheme, implementation of syntax directed translation, Intermediate-Code Generation: Directed Acyclic graphs, three address code, Postfix notation, quadruples, triples and indirect triples.

Unit-IV

Symbol Table & Error Detection and Recovery: Symbol tables: its contents and data structure for symbol tables; trees, arrays, linked lists, hash tables. Errors, lexical phase error, syntactic phase error, Semantic error, Code Optimization & Code Generation: Basics Blocks & flow graphs, common subexpression elimination, dead code elimination, constant propagation, loop and Peephole optimization, forms of objects code, machine dependent code, register allocation for temporary and user defined variables.

Suggested Readings:

1. Compilers Principles, Techniques & Tools by Alfread V. AHO, Ravi Sethi & J.D. Ullman, Addison Wesley.
2. Theory and Practice of Compiler Writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.
3. System Software by Dhamdere, 1986, MGH.
4. Principles of Sompiler Design, Narosa Publication.
5. Elements Compiler Design, Dr. M. Joseph, University Science Press.

Useful Video Links:

Unit No	Topics	Links
Unit-I	The Structure of compiler	https://youtu.be/L7B7b9phxV8?si=aFcs3kO9JbYGJozI
	Input Buffering, Specification of tokens, Regular Expression	https://youtu.be/5Vv3HHSeJUA?si=ogMow48rYdMRPBMy
	Finite Automata, Regular Expression to Finite Automata	https://youtu.be/zpuouhg1NWM?si=wy-BRoIMcRcl7B_K
Unit-II	Context Free Grammar	https://youtu.be/yS52K_CrFCc?si=a4UAhbIjIoW_h0rg
	Top-Down Parser: Recursive Descent Parsing	https://youtu.be/yE8JXOwWo5I?si=5JMmaPHftAGAr4F4
	Predictive Parsing	https://youtu.be/P9uw8XyVtF8?si=MZE8JG7J-UfplZmL
	Intermediate Code Generation	https://youtu.be/Gc6PpW_SxKY?si=pIXzxJQn48a5XLjP
Unit-III	LR Parser: LR(0), SLR(1)	https://youtu.be/tvNy8-oqoq0?si=EMQPmVanXAW02oML
	LALR(1)	https://youtu.be/QFVorwdIZRg?si=SJFJwv-FXq8ORnds
Unit-IV	Symbol Table	https://youtu.be/FQb0hQ6Bgp8?si=c2KFMQpOGzAvjXhN
	Register Allocation	https://youtu.be/mzKUVBoTIJ8?si=6TY3SD3Q50gTOO5W

Course Code	**CSE-302A**				
Category	Professional Core Courses				
Course Title	**Web Technologies**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of web technologies, Internet concepts, and web architecture. • To develop understanding of client-side and server-side web development techniques. • To enable application of web technologies for developing dynamic web applications. • To develop analytical skills related to web application design and integration.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define Internet technologies, web development concepts, markup languages, scripting techniques, and database integration methods.	Level 1: Remember
CO2	Explain web technologies, document structures, styling techniques, scripting mechanisms, and data exchange methods.	Level 2: Understand
CO3	Apply web development technologies and tools to design and implement dynamic web applications.	Level 3: Apply
CO4	Analyze web applications, data exchange mechanisms, database interactions, and client-server communication processes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser.

HTML: History of HTML, Structure of HTML Document: Text Basics, Mark up Tags, Heading-Paragraphs, Line Breaks, Understand the structure of HTML tables. Lists, Working with Hyperlinks, Understanding Frames and their needs, HTML forms for User inputs, Document: Images and Multimedia, Links and webs, Document Layout.

Cascading Style Sheet: Need for CSS, introduction to CSS, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects and structure using CSS, inline, internal and external CSS.

Unit-II

XML: Introduction of XML- Some current applications of XML, Features of XML, Anatomy of XML document, structuring data, XML namespace, Document Type Definitions and Schemas, Document object model, DOM methods, XSL, SAX, SOAP, XML vs JSON in Modern Development, Future Trends of XML.

Unit-III

PHP: Introduction to PHP,Working with Variables and Constants, Controlling Program flow, Working with Functions, Arrays, Files, and Directories, operator precedence.Working with Forms and Database, Databases : Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs, Exploring Cookies, Sessions, and PHP Security.

Unit-IV

AJAX: AJAX with PHP, PHP Code and the Complete AJAX Example, AJAX Database, Working of AJAX live search with PHP, Ajax PHP Database Form, AJAX PHP MySQL Database, connect, create DB, create table, insert data, select query.

Suggested Readings:

1. HTML Black Book by Steven Holzner, Dreamtech Press.
2. Web Technologies: Black Book, Dreamtech Press.
3. Web Applications: Concepts and Real-World Design by Knuckles, Craig D, Wiley-India.
4. Internet and World Wide Web How to program by P.J. Deitel & H.M. Deitel, Pearson.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Internet	https://youtu.be/YOXwcbwSEUo?si=gzzW4Ax-7-QEazbH
	Introduction to HTML and CSS	https://youtu.be/h_RftxdJTzs?si=d1Pdy020kgY6w_BG
Unit-II	Extensible Markup Language(XML)	https://youtu.be/-oLlHA0Uy-s?si=kxkQSMbC3NVsQONz
	Document Object Model	https://youtu.be/Uwu-A1sULMc?si=ORcmRS_2BsCFW8yu
Unit-III	Introduction to PHP	https://youtu.be/wwsWLXxKVtM?si=1XdM_dl0gmp6L9Tc
	Cookies in PHP	https://youtu.be/Tbn0H0r7d4Y?si=p143YSwlfDXKoiRV
Unit-IV	AJAX with PHP	https://youtu.be/DIufdUeDpoc?si=7ZTApYU5WUhdn_0L
	Ajax PHP Database Form	https://youtu.be/XV9x17zVZFU?si=XqIyOGgdus0bIhq8

Course Code	**CSE-304A**				
Category	Professional Core Courses				
Course Title	**Software Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of software engineering principles, processes, life cycle models, and project management practices. • To develop understanding of requirements engineering, system modeling, software design, and architectural concepts. • To enable application of software development, testing, maintenance, and project management techniques. • To develop analytical abilities for evaluating software quality, reliability, performance, and process effectiveness.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define software engineering concepts, processes, life cycle models, project management practices, and quality standards.	Level 1: Remember
CO2	Explain software requirements, modeling techniques, design principles, architectural concepts, testing methods, and quality assurance activities.	Level 2: Understand
CO3	Apply software engineering methodologies, project management techniques, design approaches, and testing strategies to software development problems.	Level 3: Apply
CO4	Analyze software systems, project parameters, quality attributes, reliability measures, and process outcomes for effective software engineering solutions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: The process, software products, emergence of software engineering, evolving role of software, software life cycle models, Software Characteristics, Applications, Software crisis.
Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation Techniques, empirical estimation techniques, COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking.

Unit-II

Requirements Analysis and specification requirements engineering, system modeling and simulation Analysis principles modeling, partitioning Software, prototyping, Prototyping methods and tools; Specification principles, Representation, the software requirements specification and reviews Analysis Modeling: Data Modeling, Functional modeling and information flow: Data flow diagrams, Behavioral Modeling; The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the control and process specification; The data dictionary; Other classical analysis methods.

System Design: Design concepts and principles: the design process: Design and software quality, design principles; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

Unit-III

Architectural Design: Software architecture, Data Design: Data modeling, data structures, databases and the data warehouse, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements into a software architecture; Transform flow, Transaction flow; Transform mapping: Refining the architectural design.

Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, white box testing, basis path testing: Control structure testing: Black box testing, testing for specialized environments, architectures and applications. Software Testing Strategies: Verification and validation, Unit testing, Integration testing, Validation testing, alpha and beta testing; System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, the debugging process debugging approaches. Software re-engineering, reverse engineering, restructuring, forward engineering.

Unit-IV

Software Reliability and Quality Assurance: Quality concepts, Software quality assurance , SQA activities; Software reviews: cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting and record keeping, review guidelines; Formal approaches to SQA; Statistical software quality assurance; software reliability: Measures of reliability and availability, The ISO 9000 Quality standards: The ISO approach to quality assurance systems, The ISO 9001 standard, Software Configuration Management. Computer Aided software Engineering: CASE, building blocks, integrated case environments and architecture, repository.

Suggested Readings:

1. Fundamentals of software Engineering by Rajib Mall, PHI.
2. Software Engineering by Nasib Singh Gill, Khanna Book Publishing Co (p) Ltd.
3. Software Engineering by Ian Somerville, Pearson Edu, 5 edition, 1999, AW
4. Software Engineering by David Gustafson, 2002, T.M.H.
5. Effective Methods for Software Testing by William Perry, John Wiley & Sons, New York, 1995.
6. Software Testing by Louise Tamres, Pearson Education Asia, 2002.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Software Crisis	https://youtu.be/Ln_LP7c23WM?si=VbTajcclrOt9sN9Y
	Software Project Management	https://youtu.be/w9BSk8MGOGM?si=SqU7aKGfy7NsrEcj
Unit-II	Introduction to requirement specification	https://youtu.be/l9XFipXoJb0?si=UHgpfj3VCno5tHjG
	Modular Design	https://youtu.be/FTyncRpLd5g?si=pmt_sPKssS4wVMnI
Unit-III	Architectural Design	https://youtu.be/IPlP2R7l-Nc?si=2xKG1D8-1PxJuEGE
	Software Testing	https://youtu.be/Q50ZyydS7pI?si=olsiSLBbKXOEn_pC
Unit-IV	The ISO 9000 Quality standards	https://youtu.be/KTePzwgNfPw?si=dN7aMBS8uJnRqSbT

Course Code	**AI-L301A**				
Category	Professional Core Courses				
Course Title	**Machine Learning Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: • To understand and implement basic machine learning algorithms for classification and prediction tasks. • To apply clustering and recommendation techniques for pattern discovery and personalized suggestions. • To perform dimensionality reduction and optimization using PCA and Gradient Descent techniques. • To develop and evaluate advanced machine learning models using Artificial Neural Networks (ANN).				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand the fundamental concepts of machine learning, including types of learning, basic algorithms, and model building techniques.	Level 2: Understand
CO2	Apply machine learning algorithms to implement solutions for classification, regression, and clustering problems using appropriate techniques.	Level 3: Apply
CO3	Apply data preprocessing, feature selection, and dimensionality reduction techniques for effective data analysis and model improvement.	Level 3: Apply
CO4	Analyze the performance of machine learning models using evaluation metrics and optimize models for better accuracy and efficiency.	Level 4: Analyze

List of Experiments:

Sr. No.	**Contents**	**COs**
1	Study the basic concept of Machine Learning	CO1
2	Write a program to implement Linear Regression for predicting continuous target values based on given input features.	CO2
3	Write a program to implement Logistic Regression for binary classification of a dataset.	CO2
4	Write a program to implement K-Nearest Neighbors (KNN) algorithm for classification problems.	CO2
5	Write a program to implement Decision Tree classifier for predicting outcomes based on input data.	CO3
6	Write a program to implement Random Forest algorithm for classification and regression tasks.	CO4
7	Write a program to implement Support Vector Machine (SVM) for classification of data points.	CO3

8	Write a program to implement Naive Bayes classifier for text or categorical data classification.	CO3
9	Write a program to implement K-Means clustering algorithm for grouping similar data points.	CO3
10	Write a program to implement Principal Component Analysis (PCA) for dimensionality reduction.	CO3
11	Write a program to implement Gradient Descent algorithm for optimizing a machine learning model.	CO4
12	Write a program to implement Artificial Neural Network (ANN) for classification or prediction tasks.	CO4
13	Write a program to implement a Recommender System using collaborative filtering technique.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Useful Video Links:

Experiment Name	**Virtual Lab Link**
Implement Random Forest for Multi-Class Classification	https://www.youtube.com/watch?v=5ONlGP0Nx3Q
Gradient Descent	https://www.youtube.com/watch?v=JA5rIxOve20
Principal Component Analysis (PCA)	https://www.youtube.com/watch?v=hkCT-6KJAK0
K-Means Clustering	https://www.youtube.com/watch?v=oFr4JX75MCc

Course Code	**CSE-L001A**				
Category	Professional Core Course				
Course Title	**Compiler Design Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are • To provide knowledge of lexical analysis, syntax analysis, and compiler construction concepts. • To develop understanding of LEX and YACC tools. • To enable application of parsing techniques and grammar transformations. • To develop analytical abilities for grammar and parsing evaluation.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain lexical analysis, parsing, grammar representation and compiler construction tools.	Level 2: Understand
CO2	Implement lexical and syntax analysis programs using LEX, YACC and string processing techniques.	Level 3: Apply
CO3	Apply parsing techniques, grammar transformations and stack operations in compiler design.	Level 3: Apply
CO4	Analyze grammars, parse trees, recursion, factoring methods and compiler processing results.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**	**COs**
1	Study of LEX & YACC TOOLS LEX - A Lexical Analyzer Generator.	CO1
2	Write a program to count the total number of Blank Spaces in the String.	CO2
3	Write a program to find whether a given String is an Identifier or not.	CO2
4	Write a program to check whether a string is keyword or not.	CO2
5	Write a program to find whether a string is constant or not.	CO2
6	Write a program to check and generate parse tree.	CO3
7	Write a program to find the First of non-terminals in the String.	CO3
8	Write a program to find the LEFT RECURSION.	CO4

9	Write a Program to find Left Factoring in the String.	CO4
10	Write a program for stack operations.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Useful Video Links:

Experiment Name	**Virtual Lab Link**
Write a program to find whether a given String is an Identifier or not.	https://gr16vlabiem.netlify.app/identifier
Write a Program to generate Left Most Derivation and Right Most Derivation.	https://gr16vlabiem.netlify.app/leftrightderivation
Write a Program to check and generate parse tree.	https://gr16vlabiem.netlify.app/parsetree

Course code	**CSE-L302A**				
Category	Professional Core Courses				
Course title	**Web Technologies Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand the fundamentals of web technologies including HTML, CSS, XML and PHP. ● To design and develop static web pages using HTML elements and styling techniques. ● To apply CSS and XML for structuring and presenting web content effectively. ● To develop dynamic web applications using PHP and basic programming concepts.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	**Skill Demonstrated**
CO1	Explain the structure and usage of HTML tags, lists, hyperlinks, frames, forms, and XML concepts for designing web pages.
CO2	Apply HTML, CSS, and XML techniques to develop structured web pages including navigation, multimedia integration, and styled layouts.
CO3	Implement PHP programs using variables, control structures, functions, arrays, and loops to solve basic programming problems.
CO4	Analyze and develop dynamic web applications by integrating PHP with XML, CSS, and related technologies for data processing and presentation.

List of Experiments

Sr. No.	**Contents**	**COs**
1	Study of various tags used in HTML.	CO1
2	Write a program to create a simple html page using heading and text element.	CO1
3	Write a program to create ordered and an ordered list.	CO1
4	Write a program to create definition list using HTML.	CO1
5	Write a program to connect more than two pages using hyperlink in HTML.	CO1
6	Write a program to import images and videos in HTML.	CO2
7	Write a program to implement navigation frame in HTML.	CO2
8	Write a program to implement an inline floating frame.	CO2
9	Write a program to create a registration form using HTML and CSS.	CO2
10	Write a program to implement inline CSS.	CO2
11	Write a program to implement internal CSS.	CO2

12	Write a program to implement external CSS.	CO2
13	Write a program to create a student marksheet using table in HTML.	CO2
14	Write an XML program to accept student details (Name, I'd, Branch, CGPA).	CO1
15	Write a program to display Catalog created using CSS and XSL.	CO4
16	Write a PHP program to perform the addition of two numbers.	CO3
17	Write a PHP program to display numbers from 1 to 10 using loops (for, while).	CO3
18	Write a PHP program to demonstrate functions (with and without parameters).	CO3
19	Write a PHP program to sort an array.	CO3
20	Write a PHP program to calculate factorial of a number.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Write a program to create ordered and an ordered list.	https://youtu.be/3cTpjhD0YlQ?si=25aBaaZJqs5iEHO1
Write a program to create a registration form using HTML and CSS.	https://youtu.be/ttNqr6tU4p8?si=x_ucIj01UQnpTnG4
Write a PHP program to display numbers from 1 to 10 using loops (for, while).	https://youtu.be/UtYGSL06vo4?si=TAXJnYEZYzBZ1Q98
Write a PHP program to calculate factorial of a number.	https://youtu.be/OtmKgh8DlGM?si=Z40cm9sRd9AHgbeQ

Course Code	**DS-303A**				
Category	Professional Elective Courses				
Course Title	**Predictive Analytics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI (Common for B. Tech. CSE/CSE-DS)**
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide knowledge of predictive analytics concepts, statistical models, and analytical frameworks. • To develop understanding of regression, classification, decision trees, and machine learning techniques. • To enable application of predictive modeling and data preprocessing methods for real-world analytics problems. • To develop analytical abilities for model evaluation, variable selection, dimensionality reduction, and performance optimization.				
Assessment	40 Marks				
End Semester Practical Examination	60 Marks				
Total	100				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define predictive analytics concepts, analytical frameworks, regression models, classification techniques, and machine learning fundamentals.	Level 1: Remember
CO2	Explain predictive modeling methods, data preprocessing techniques, feature selection approaches, and analytical processes.	Level 2: Understand
CO3	Apply predictive analytics techniques, statistical models, and machine learning methods to solve real-world problems.	Level 3: Apply
CO4	Analyze predictive models using evaluation measures, dimensionality reduction methods, regularization techniques, and validation strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Introduction: The Analytics Life Cycle, Introduction to Predictive Analytics, Matrix Notation, Basic Foundations, Model, Method and Feature Selection, CRISP-DM framework, and data partitioning (training/validation sets).
Regression: Covariance, Correlation and ANOVA review; Simple Linear Regression, OLS Model Diagnostics, Dummy Variables, Multivariate Regression, OLS Assumptions, Weighted Least Squares (WLS), Generalized Linear Models (GLM).

Unit II

Classification Models: Introduction, Binomial Logistic Regression, Multinomial Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis.
Decision Trees: Introduction Regression Trees, Regression Tree Issues, Classification Trees, Pruning Trees, Bootstrap Aggregation (Bagging), Random Forest Models, Support Vector Machines (SVM), and Neural Networks.

Unit-III

Data Pre-Processing: Overview, Variable Types, Introduction to Data Transformations,
Data Transformations: Categorical to Dummy Variables, Polynomials, Box-Cox Transformation, Log & Elasticity Models, Logit Transformation, Count Data Models, Centering, Standardization, Rank Transformations, Lagging Data (Causal Models), Data Reduction.

Unit-IV

Variable Selection: Dimensionality Issues, Multi-Collinearity, Variable Selection Methods, Step Methods.
Dimensionality: Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO, Dimension Reduction Models, Principal Components Regression (PCR), Partial Least Squares (PLS).
Machine Learning: Machine Learning Overview, Bias vs. Variance Trade-off, Error Measures, Cross-Validation.

Suggested Readings:

1. An Introduction to Statistical Learning: with Applications in R by James, Witten, Hastie and Tibshirani, Springer, 1st Edition, 2013.
2. The Elements of Statistical Learning-Data Mining, Inference, and Prediction by Trevor Hastie, Robert Tibshirani, Jerome Friedman, Second Edition , Springer Verlag, 2009.
3. Predictive & Advanced Analytics, IBM ICE Publication.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Predictive Analytics	https://youtu.be/suIMSpBJiyM?si=wghj_qWKuUc01sS0
	Method and Feature Selection	https://youtu.be/0xFT0yvqRo4?si=BC3RJuyDRl8b8kdQ
	CRISP-DM framework data partitioning (training/validation sets)	https://youtu.be/q_okDS2RtzY?si=L0-fXwDtLUchigXM
Unit-II	Multinomial Logistic Regression	https://youtu.be/cM4lmkq8XsU?si=Z0F0fT0CgHIBJWK7
	Linear Discriminant Analysis	https://youtu.be/LNL4G87DpI0?si=jthNR0t1c4syCrkM
	Introduction Regression Trees	https://youtu.be/1GZDVRskXGE?si=Mlc1rNSDs_5c2zFB
	Support Vector Machines (SVM)	https://youtu.be/3ki3RKdbcPo?si=Og-G9XnbOPUw1WBf
Unit- III	Data pre-processing	https://youtu.be/L_DeunKU-FA?si=EYEVxpjcKJlqeJSj
	Categorical to Dummy Variables	https://youtu.be/aMPeChbJg9A?si=7A0vzl-UDnTH3V92
	Standardization, Rank Transformations,	https://youtu.be/J_rDIm7dI3Y?si=y778gzeyW5gfaiRV
	Lagging Data (Causal Models)	https://youtu.be/LpRC9ds6GIc?si=MXYyawUQo_WGsJiT
Unit- IV	Variable Selection Methods, Step Methods.	https://youtu.be/9h1YikP2Sno?si=hr5O_7TK9lbpLAzy
	Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO	https://youtu.be/whA8Geg4Knk?si=6Ps80ti6EE4RYbPj
	Principal Components Regression (PCR) Partial Least Squares (PLS)	https://youtu.be/SWfucxnOF8c?si=4zx8fArev1W5EZZc https://youtu.be/cSeMy8xJvNA?si=vukpap1nDEGKnb_O

<table>
<tr><td>Course Code</td><td colspan="5">CSE-306A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Software Project Management</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of software project management concepts, planning methods, and project life cycle activities.
To develop understanding of estimation, scheduling, risk management, and project evaluation techniques.
To enable application of resource allocation, monitoring, contract management, and team management practices.
To develop analytical skills for software quality management and project control.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define software project management concepts, planning techniques, estimation methods, scheduling approaches, and quality standards.	Level 1: Remember
CO2	Explain project evaluation, risk management, resource allocation, monitoring mechanisms, and quality management practices.	Level 2: Understand
CO3	Apply project planning, estimation, scheduling, resource management, and monitoring techniques in software projects.	Level 3: Apply
CO4	Analyze software project performance, quality measures, risk factors, organizational structures, and project control mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Software Project Management (SPM): Definition of a Software Project (SP), SP Vs. other types of projects activities covered by SPM, categorizing SPs, project as a system, management control, requirement specification, information and control in organization.
Stepwise Project planning: Introduction, selecting a project, identifying project scope and objectives, identifying project infrastructure, analyzing project characteristics, identifying project products and activities, estimate efforts each activity, identifying activity risk, allocate resources, review/ publicize plan.

Unit-II

Project Evaluation & Estimation: Cost benefit analysis, cash flow forecasting, cost benefit evaluation techniques, risk evaluation. Selection of an appropriate project report; Choosing technologies, choice of process model, structured methods, rapid application development, waterfall, V-process model, spiral models, Prototyping, Incremental model, Evolutionary model, Agile model, delivery, Albrecht function point analysis.

Activity planning & Risk Management: Objectives of activity planning, project schedule, projects and activities, sequencing and scheduling activities, network planning model, representation of lagged activities, adding the time dimension, backward and forward pass, identifying critical path, activity throat, shortening project, precedence networks.
Risk Management: Introduction, the nature of risk, managing risk, risk identification, risk analysis, reducing the risks, Evaluating schedule risk using PERT, calculating the z values.

Unit-III

Resource allocation: Introduction, the nature of resources, identifying resource requirements, scheduling resources creating critical paths, counting the cost, being specific, publishing the resource schedule, cost schedules, the scheduling sequence.
Monitoring the control: Introduction, creating the frame work, collecting the data, visualizing progress, cost monitoring, earned value, prioritizing monitoring, getting the project back to target, change control.

Unit-IV

Managing contracts and people: Introduction, types of contracts, stages in contract, placement, typical terms of a contract, contract management, acceptance, Managing people and organizing terms: Introduction, understanding behaviour, organizational behaviour: a back ground, selecting the right person for the job, instruction in the best methods, motivation, working in groups, becoming a team, decision making, leadership, organizational structures.
Software quality: Introduction, the place of software quality in project planning, the importance of software quality, defining software quality, ISO 9126, Practical software quality measures, product versus process quality management, external standards, techniques to help enhance software quality.

Reference Books:

1. Software Project Management (2nd Edition) by Bob Hughes and Mike Cotterell, 1999, TMH.
2. Software Engineering – A Practitioner's Approach by Roger S. Pressman (5th Edition), 2001, MGH.
3. Software Project Management by Walker Royce, 1998, Addison Wesley.
4. Managing Global software Projects by Ramesh, 2001, TMH.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Software Project Management	https://youtu.be/ilHPCbkZLV4?si=swk2REfI1YMaggY8
	Stepwise Project Planning	https://youtu.be/W2EdffbwgcM?si=x7CLBtnWydiaWh3r
Unit-II	Project Evaluation	https://youtu.be/8RuJfk1Xj2U?si=cf2vUFxsYWlC4CGg
	Life cycle models	https://youtu.be/yC0A6_nYPYQ?si=UomwV6gBpilNFL
	Project Scheduling	https://youtu.be/AvwZ7JO8LNk?si=bK1llghcmFkYNMXQ
	Risk Management	https://youtu.be/PehmL5jOmW8?si=jWbx2PPO8jzFyxWW
Unit-III	Resource allocation	https://youtu.be/Sg5eFtcugEA?si=71KLxlFDB-WtBMiY
	Project monitoring & control	https://youtu.be/3Rjj4IyO3hc?si=3b9a2jPq1fX67zvm
Unit-IV	Contract management	https://youtu.be/olrW1tqGnsM?si=udYfA2JcE2Xc7lPe
	Organizational structure	https://youtu.be/MpNjo7bhBTg?si=nOTIoHpqyGB_Zeec
	Software quality management	https://youtu.be/zQXss82WudM?si=NLhhtS397sXZYMpN
	ISO 9000	https://youtu.be/ODQNex8xtjU?si=fE8W_yNv1JzoptIz
	ISO 9126	https://youtu.be/X-3JAyHtSlo?si=-48rGC0RpE7LQfgF

<table>
<tr><td>Course code</td><td colspan="5">CSE-308A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Digital Image Processing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of digital image processing concepts, image representation, and transformation techniques.
To develop understanding of image enhancement, restoration, segmentation, and feature extraction methods.
To enable application of image processing techniques for image analysis and interpretation.
To develop analytical abilities for evaluating image processing algorithms and outcomes.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">100</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define digital image processing concepts, image models, transformations, enhancement techniques, and feature extraction methods.	Level 1: Remember
CO2	Explain operation of image transformation, enhancement, restoration, compression, segmentation, representation techniques and analysis procedures.	Level 2: Understand
CO3	Apply image processing techniques for image enhancement, segmentation, feature extraction, and analysis.	Level 3 : Apply
CO4	Analyze image processing algorithms, segmentation results, feature representations, and image interpretation outcomes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

Unit-II

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms.

Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering

Unit-III

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-IV

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested Readings:

1. Digital Image Processing by Rafael C. Gonzalez, Richard E. Woods, Pearson, Third Edition, 2010.
2. Fundamentals of Digital Image Processing by Anil K. Jain, Pearson, 2002.
3. Digital Image Processing by Kenneth R. Castleman, Pearson, 2006.
4. Multidimensional Digital Signal Processing by D, E. Dudgeon and RM. Mersereau, Prentice Hall Professional Technical Reference, 1990.
5. Digital Image Processing by William K. Pratt, John Wiley, New York, 2002.

Useful Video Links:

Unit	Topic	NPTEL Video Lecture Link
Unit-I	Introduction to Digital Image Processing	https://digimat.in/nptel/courses/video/117105135/L01.html
	Image Digitalization, Sampling & Quantization	https://digimat.in/nptel/courses/video/117105135/L03.html
	Color Fundamentals & Image Representation	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
Unit-II	Histogram Processing	https://digimat.in/nptel/courses/video/117105135/L34.html
	Histogram Equalization & Specification	https://digimat.in/nptel/courses/video/117105135/L35.html
	Fourier Transform – I	https://www.youtube.com/watch?v=11b5NnpEoVE
	Image Transformations & Frequency Domain	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_7/7_intro.html
Unit-III	Image Compression Fundamentals	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_7/7_intro.html
	JPEG Compression	https://onlinecourses-archive.nptel.ac.in/noc18_ee40/preview
	Coding Redundancy & Huffman Coding	https://digimat.in/nptel/courses/video/117105135/117105135.html
Unit-IV	Edge Detection & Boundary Detection	https://digimat.in/nptel/courses/video/117105135/117105135.html
	Thresholding & Segmentation	https://arxiv.org/abs/1909.05084
	Hough Transform & Region Based Segmentation	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
	Boundary Representation & Descriptors	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_1/1_intro.html

Course Code	**CSE-310A**				
Category	Professional Elective Courses				
Course Title	**Mobile Application Development**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of mobile operating systems, architectures, development environments, and security mechanisms. • To develop understanding of mobile application frameworks, user interfaces, communication methods, and deployment techniques. • To enable application of mobile development tools and technologies for creating mobile applications. • To develop analytical skills for evaluating mobile application performance, security, communication, and deployment strategies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define mobile operating systems, architectures, development frameworks, communication mechanisms, and security concepts.	Level 1: Remember
CO2	Explain mobile application development processes, development tools, user interface frameworks, communication methods, and deployment techniques.	Level 2: Understand
CO3	Apply mobile development technologies, frameworks, tools, and services to develop mobile applications.	Level 3: Apply
CO4	Analyze mobile application architectures, security mechanisms, resource management techniques, communication protocols, and deployment strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

Unit-II

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments, Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

Unit-III

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

Unit-IV

Android: Introduction to Android, Architecture, memory management, communication
iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

Suggested Readings:

1. Professional Mobile Application Development by Jeff McWherter, Scott Gowell, Wiley India.
2. Android Application Development All-in-One For Dummies by Barry Burd, Wiley Publications.
3. Learning Apache Cordova by John M. Wargo, Addison-Wesley.
4. iOS Programming: The Big Nerd Ranch Guide by Big Nerd Ranch Guides.

Useful Video links:

Unit No.	Topics	Links
Unit-I	Mobile OS, structure, multitasking, memory management, security, multimedia features	https://nptel.ac.in/courses/106106147
Unit-II	Worklight, adapters, debugging, fragments, client technologies, Apache Cordova	https://cordova.apache.org/
Unit-III	Android/iOS development, UI frameworks, authentication, notifications, globalization	https://developer.apple.com/tutorials/
Unit-IV	Android & iOS architecture, memory management, communication protocols, deployment	https://nptel.ac.in/courses/106106147

Annexure AC / 5.10

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations For

Bachelor of Technology Computer Science and Engineering- Artificial Intelligence and Machine Learning (B.Tech CSE-AIML)

3rd Year (A-Scheme)

Effective from the Academic Session 2026-27

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	2 Practical (P) per week	1 Credit
4	2 Seminar/Industrial Training per week	1 Credit

2. RANGE OF CREDIT

A range of credits from 160 to 180 is required for the award of an Undergraduate Degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	73*
2	Professional Elective Courses (Relevant to chosen specialization/branch)	12*
3	Engineering Science Courses	26*
4	Basic Science Courses	21*
5	Humanities and Social Sciences including Management courses	12*
6	Multidisciplinary Open Electives Courses	9*
7	Project work, seminar and internship in industry or appropriate work place/academic and research institutions in India/abroad	16*
8	Value Added Courses	01*
9	Mandatory Courses	Non Credit
	Total Credits	170*

***Minor variation is allowed as per need of the respective disciplines*

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses	PEC
3	Engineering Science Courses	ESC
4	Basic Science Courses	BSC
5	Humanities and Social Sciences including Management courses	HSMC
6	Multidisciplinary Open Electives Courses	MOEC
7	Value Added Courses	VAC
8	Project	PR
9	Mandatory Courses	MC
10	Lab Courses	LC
11	Practical Training	PT
12	Internship	INT

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning (B.Tech CSE-AIML) – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	AI-301A	Machine Learning	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	AI-303A	Fuzzy Logic and Soft Computing	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	AI-305A	Pattern Recognition	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	CSE-305A	Design and Analysis of Algorithms	3	0	0	3	3	40	60		100	3
5	Engineering Science Courses	ECE-002A	Mobile and Wireless Communications	3	0	0	3	3	40	60		100	3
6	Professional Elective Courses	Refer Table-II	Professional Elective-II	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	AI-L301A	Machine Learning Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	AI-L303A	Fuzzy Logic and Soft Computing Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	AI-L305A	Pattern Recognition Lab	0	0	2	2	1	25		25	50	3
10	Professional Core Courses	CSE-L305A	Design and Analysis of Algorithms Lab Using C++	0	0	2	2	1	25		25	50	3
11	Practical Training	PT-301A	Practical Training-I	0	0	2	2	1	50			50	-
Total Credits								**24**				**850**	

Note:

I. Students must choose one course from the Professional Elective–II category (Table II). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

II. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.. Students required getting passing marks otherwise, He / She will be required to repeat practical training-I.

Table II: Professional Elective - II

Sr. No.	Course Code	Course Title
1	CSE-301A	Computer Networks
2	CSE-315A	Data Warehouse and Mining
3	AI-307A	DevOps Overview
4	AI-309A	AI Ethics and Responsible AI
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)*

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Computer Science and Engineering-Artificial Intelligence and Machine Learning (B.Tech CSE-AIML) – 6th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	AI-001A	Neural Networks	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	AI-302A	Recommender Systems	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	CSE-002A	Big Data Analytics	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	AI-304A	Reinforcement Learning	3	0	0	3	3	40	60		100	3
5	Professional Elective Courses	Refer Table-III	Professional Elective-III	3	0	0	3	3	40	60		100	3
6	Multidisciplinary Open Elective Courses	Refer Table-IV	Multidisciplinary Open Elective-I	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	AI-L001A	Neural Networks Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	AI-L302A	Recommender Systems Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	CSE-L002A	Big Data Analytics Lab	0	0	2	2	1	25		25	50	3
10	Mandatory Courses (Non-Credit)	MC-301A	Constitution of India	2	0	0	2	-	40	60			3
Total Credits								**22**				**750**	

Note:

I. MC-301A is a mandatory non –credit course in which the students will be required passing marks in theory. However these marks will not be added in the total marks.

II. Students must choose one course from the Professional Elective–III category (Table III) and one course from the Open Elective–I category (Table IV). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

III. At the end of 6th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

IV. **For Working Professionals:** Students shall submit a Training/Project Report based on their work in their respective company/organization for the period of the summer/industrial training. The evaluation shall be carried out in the 7th Semester.

Table III: Professional Elective - III

Sr. No.	Course Code	Course Title
1	CSE-303A	Formal Languages and Automata
2	AI-306A	Explainable AI
3	AI-308A	Swarm Intelligence
4	CSE-308A	Digital Image Processing
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)*

Note: Students have to select any one course from the above list, provided that the course has not been studied earlier

Table IV: Multidisciplinary Open Elective-I

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

<table>
<tr><td>Course Code</td><td colspan="5">AI-301A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Machine Learning</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of machine learning concepts, techniques, and applications.
To develop understanding of data preprocessing, feature engineering, and dimensionality reduction methods.
To enable application of machine learning algorithms for prediction and pattern discovery.
To develop analytical skills for evaluating and improving machine learning models.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define machine learning concepts, learning paradigms, techniques, and applications.	Level 1: Remember
CO2	Explain data preprocessing, feature representation, dimensionality reduction, and learning methodologies.	Level 2: Understand
CO3	Apply machine learning algorithms to solve classification, prediction, and clustering problems.	Level 3: Apply
CO4	Analyze machine learning models using appropriate performance measures and evaluation techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Machine Learning: Definition, History, Need, Features, Block diagrammatic representation of learning machines, Classification of Machine Learning: Supervised learning, Unsupervised learning, Reinforcement Learning, Machine Learning life cycle, Applications of Machine Learning.

Unit-II

Dimensionality reduction: Definition, Row vector and Column vector, how to represent a dataset, how to represent a dataset as a Matrix, Data preprocessing in Machine Learning: Feature Normalization, Mean of a data matrix, Column Standardization, Co-variance of a Data Matrix, Principal Component Analysis for Dimensionality reduction

Unit-III

Supervised Learning: Definition, how it works, Types of Supervised learning algorithms k - Nearest Neighbours, Naïve Bayes, Decision Trees, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines, Generalized Linear Models, Non-linearity and Kernel Methods

Unit-IV

Unsupervised Learning: Clustering: K-means. Ensemble Methods: Boosting, Bagging, Random Forests.
Evaluation: Performance measurement of models in terms of accuracy, confusion matrix, precision & recall, F1-score, receiver Operating Characteristic Curve (ROC) curve and AUC, Median absolute deviation (MAD), Distribution of errors

Suggested Readings:

1. Introduction to machine learning by E. Alpaydin.
2. The Elements of Statistical Learning Data Mining, Inference, and Prediction by T Hastie, R Tibshirani and J Friedman, 2nd Edition, Springer, 2009.
3. Pattern Recognition and Machine Learning by C. M. Bishop, Springer, 2010.
4. Pattern Classification by R. O. Duda, P. E. Hart, and D.G. Stork, John Wiley and Sons, 2012.
5. Networks and Learning Machines by Simon O. Haykin, Neural, Pearson Education, 2016.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Machine Learning	https://youtu.be/fC7V8QsPBec?si=EIpHubT-jNunHaMI
	Supervised Learning	https://youtu.be/OTAR0kT1swg?si=RfDSfvDNG8eWYbMS
	Unsupervised Learning	https://youtu.be/HTSCbxSxs-g?si=_ZIAGWXSR_0GADAU
	Reinforcement Learning	https://youtu.be/9vMpHk44XXo?si=mDfGQrhR3JnBraBD
Unit-II	Dimensionality Reduction: Principal Component Analysis (PCA) & kernel PCA	https://www.youtube.com/watch?v=YepECGlOl4Y
	Introduction to Data Preprocessing	https://www.youtube.com/watch?v=cO6lrQuepcs
Unit-III	Types of supervised learning	https://www.youtube.com/watch?v=5NSKURYzU70
	Linear Regression	https://youtu.be/_M7Km1XZERU?si=NoLgPErLdkv6frY4
	Logistic Regression	https://youtu.be/g__LURKuIj4?si=JtwGguSfsh_KnguR
Unit-IV	Unsupervised Learning & K-means	https://www.youtube.com/watch?v=FeVrAK77mV8
	The ROC Curve	https://www.youtube.com/watch?v=6RjcFVm_k4c

Course Code	**AI-303A**				
Category	Professional Core Courses				
Course Title	**Fuzzy Logic & Soft Computing**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are • To recall basics of soft computing, fuzzy logic, ANN, and GA. • To understand working principles of fuzzy systems, neural networks, and GA. • To apply soft computing methods to real-world problems. • To analyze and compare soft computing techniques for decision-making and optimization.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Recall basic concepts of soft computing, fuzzy sets, neural networks, and genetic algorithms.	Level 1: Remember
CO2	Explain principles of fuzzy logic, neural networks, genetic algorithms, and their basic operations.	Level 2: Understand
CO3	Apply soft computing techniques such as fuzzy logic, ANN, and genetic algorithms for solving engineering and real-world problems.	Level 3: Apply
CO4	Analyze and compare different soft computing techniques including fuzzy systems, neural networks, genetic algorithms, and neuro-fuzzy systems for optimization and decision-making.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction To Soft Computing: Aims of Soft Computing, Foundations of Fuzzy Sets Theory, Basic Concepts and Properties of Fuzzy Sets, Elements of Fuzzy Mathematics, Fuzzy Relations, Fuzzy Logic.
Application Of Fuzzy Sets: Applications of Fuzzy Sets, Fuzzy Modeling, Fuzzy Decision Making, Pattern Analysis and Classification-Fuzzy Control Systems, Fuzzy Information Processing, Fuzzy Robotics.

Unit-II

Artificial Neural Networks: Artificial Neural Networks, Models of Neuron-Networks, Architecture of Feed Forward Neural Networks, Recurrent Neural Networks, Learning methods-supervised and unsupervised learning, Time Delay Neural Networks, Radial Basis Function Neural Networks, Adaptive Resonance Theory (ART) Neural Networks, Associative Neural Memory Models, and Application of ANN.

Unit-III

Genetic Algorithms: Main Operators- Genetic Algorithm Based Optimization, Principle of Genetic Algorithm, Genetic Algorithm with Directed Mutation, Comparison of Conventional and Genetic Search Algorithms Issues of GA in practical implementation. Introduction to Particle swarm optimization, PSO operators-GA and PSO in engineering applications.

Unit-IV

Neuro-Fuzzy Technology: Fuzzy Neural Networks and their learning, Architecture of Neuro-Fuzzy Systems, Generation of Fuzzy Rules and membership functions, Fuzzification and Defuzzyfication in Neuro-Fuzzy Systems, Neuro-Fuzzy Identification, Neuro Fuzzy Control, Combination of Genetic Algorithm with Neural Networks, Combination of Genetic Algorithms and Fuzzy Logic, Neuro-Fuzzy and Genetic Approach in engineering applications.
Programming Using MATLAB: Using Neural Network toolbox, Using Fuzzy Logic toolbox, Using Genetic Algorithm & directed search toolbox.

Suggested Readings:

1. Soft Computing and Its Applications by Rafik A. Aliev and Rashad R. Aliev, World Scientific Publishing Co. Pvt. Ltd., 2001.
2. Elements of Artificial Neural Networks by Kishan Mehrotra, Chilukuri K. Mohan and Sanjay Ranka, The MIT Press, 1997.
3. Neuro fuzzy and soft computing by Juh Shing Roger Jang,Cheun Tsai Sun,Eiji Mizutani, Prentice Hall, 1997.
4. An Introduction to fuzzy logic applications in intelligent Systems by Ronald R.Yager, Lofti Zadeh, Kluwer Academic, 1992.
5. Genetic Fuzzy Systems: Evolutionary Tuning and Learning of Fuzzy Knowledge Bases by by Oscar Cordón, Francisco Herrera, Frank Hoffmann and Luis Magdalena, World Scientific Publishing Co. Pvt. Ltd., 2001.

Useful Video links:

Unit No.	Topic	Link
Unit-I	Introduction to Fuzzy Sets	https://youtu.be/IZWTduVCrf8?si=LdwFv-uYpwQRZy5B
	Applications of Fuzzy Sets	https://youtu.be/aVsPJYxyq04?si=MHgjQyAInniTv18N
Unit-II	Introduction to Artificial Neural Network	https://youtu.be/xbYgKoG4x2g?si=bHn3rcaIYtGOhGoi
	Supervised Learning	https://youtu.be/OTAR0kT1swg?si=DyWLkQx945vqURM5
Unit-III	Genetic Algorithm	https://youtu.be/THSNf9mPsmA?si=Tv8f2tYD8e3gAuWv
	Particle swarm optimization	https://youtu.be/8dpYjgRskgQ?si=RPTIGAGsn3Jgv63-
Unit-IV	Fuzzy Neural Networks	https://youtu.be/xwUKQcT1bKc?si=kKCAVYKpuYynuKJD
	Programming using MATLAB	https://youtu.be/IuEOMyGuuIg?si=9yQJfwrUxSx9qrrX

Course code	**AI-305A**				
Category	Professional Core Courses				
Course title	**Pattern Recognition**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of pattern recognition concepts, pattern representation, and classification methods. • To develop understanding of statistical classification, feature extraction, and dimensionality reduction techniques. • To enable application of classification and clustering techniques to pattern recognition problems. • To develop analytical abilities for evaluating pattern recognition methods and classifier performance.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define pattern recognition concepts, feature representation methods, classification principles, and clustering techniques.	Level 1: Remember
CO2	Explain statistical classification, feature extraction, dimensionality reduction, and clustering methods.	Level 2: Understand
CO3	Apply classification, feature reduction, and clustering techniques to pattern recognition problems.	Level 3 : Apply
CO4	Analyze pattern recognition methods and classifier performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Pattern Recognition: Introduction to pattern recognition, pattern recognition systems, patterns and feature vectors, feature space, pattern representation, supervised and unsupervised learning, training and testing of classifiers, pattern recognition system design cycle, applications of pattern recognition.
Distance and similarity measures: Euclidean distance, Manhattan distance and Mahalanobis distance. Nearest neighbour classifier and K-nearest neighbour classifier.

Unit-II

Statistical Pattern Classification: Introduction to statistical decision theory, Bayesian decision theory, Bayes classifier, discriminant functions, decision regions and decision boundaries, minimum error rate classification. Normal density and Gaussian distribution, classification using normal distributions, linear and quadratic discriminant functions, basics of maximum likelihood estimation.

Unit-III

Feature Selection and Dimensionality Reduction: Introduction to features, feature extraction and feature selection, characteristics of good features, need for dimensionality reduction, curse of dimensionality. Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Fisher's linear discriminant, feature normalization and applications of dimensionality reduction.

Unit-IV

Clustering and Performance Evaluation: Introduction to clustering, similarity and distance measures in clustering, K-means clustering, hierarchical clustering, agglomerative clustering, single-linkage and complete-linkage methods.
Classifier performance evaluation: confusion matrix, accuracy, precision, recall and F1-score. Applications of pattern recognition in image recognition, speech recognition, handwriting recognition and biometric systems.

Suggested Readings:

1. Pattern Classification by Duda, R. O., Hart, P. E. and Stork, D. G., Wiley.
2. Pattern Recognition and Machine Learning by Bishop, C. M., Springer.
3. Pattern Recognition by Theodoridis, S. and Koutroumbas, K., Academic Press.
4. Fundamentals of Digital Image Processing by Jain, A. K., Prentice Hall.

Useful Video Links

Unit No.	Topics	Links
Unit-I	Introduction to Pattern Recognition	https://youtu.be/mfePdDh9t6Q?si=diJuH1bWaf5DUE1V
	Pattern Recognition Systems and Applications	https://youtu.be/U5xsX2ersHQ?si=koZ0h1YYQ2uqjStW
	Distance and Similarity Measures	https://youtu.be/mfePdDh9t6Q?si=5iMUbc2cPJYAkkmm
	K-NN Classification	https://youtu.be/2ATqoglcHus?si=1z6lyIIMfJ4bXP6d
Unit-II	Bayesian Decision Theory and Bayes Classifier	https://youtu.be/Z66_2_VG_k8?si=uphWtWTOkpWqAlMx
	Discriminant Functions and Decision Boundaries	https://youtu.be/FLyEbVawmvU?si=9uVX4E6P9aZiBAm7
	Maximum Likelihood Estimation	https://youtu.be/0QbjCAK4ijw?si=7BHBrTHgRqYzzcal
Unit-III	Feature Selection and Dimensionality Reduction	https://youtu.be/0P9gUYQ38cI?si=hsaAr7Yu9ouuEtF7
	Principal Component Analysis (PCA)	https://youtu.be/0P9gUYQ38cI?si=cP6hEnfNCWXAaPZd
Unit-IV	Introduction to Clustering	https://youtu.be/UUu9CG4fndk?si=9hjpBlQj6Nj7I08A
	K-Means Clustering	https://youtu.be/sU8YC4urd-w?si=jCHmiRBGeYr5342B

<table>
<tr><td>Course Code</td><td colspan="5">CSE-305A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Design and Analysis of Algorithms</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of algorithm design techniques and complexity analysis.
To develop understanding of algorithmic paradigms and optimization methods.
To enable application of algorithms for solving computational problems.
To develop analytical skills for evaluating algorithm efficiency and complexity.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define algorithm design concepts, complexity measures, design paradigms, and computational problem classes.	Level 1: Remember
CO2	Explain algorithmic strategies, optimization techniques, and complexity concepts used in problem solving.	Level 2: Understand
CO3	Apply appropriate algorithm design techniques to solve computational and optimization problems.	Level 3: Apply
CO4	Analyze algorithms and computational problems based on correctness, efficiency, and complexity.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Algorithms: Algorithm, Performance Analysis (Time and Space complexity), Asymptotic Notation (Big OH, Omega and Theta)-best, average and worst-case behaviour.
Divide and Conquer: General method, Binary Search, Merge Sort, Quick Sort, and other sorting algorithms with divide and conquer strategy, Strassen's Matrix Multiplication algorithms.

Unit-II

Greedy Method: General method, Fractional Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Single source shortest paths.
Dynamic Programming: General method, Optimal Binary Search Trees, 0/1 knapsack, The Travelling Salesperson problem.

Unit-III

Back Tracking: General method, The 8-Queen's problem, Sum of subsets, Graph Colouring, Hamiltonian Cycles. Branch and Bound: The method, 0/1 knapsack problem, Travelling Salesperson problem, Efficiency considerations.

Unit-IV

NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph problems, NP hard scheduling problems, NP hard code generation problems, and Some simplified NP hard problems.

Suggested Readings:

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publication.
2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald Lrivest: 1990, TMH.
3. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E ., 1974, Addison Wesley.
4. Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetnieni, 1997, MGH.

Useful Video links:

Unit No.	Topic	Link
Unit-I	Asymptotic Notation	https://youtu.be/EL9T1ngiCqA?si=oaMBKNhfiIOODUlM
	Divide and Conquer Paradigm	https://youtu.be/xdD0nIWe0wA?si=P3DQs80dHBg3-aiM
Unit-II	Minimum Cost Spanning Tree	https://youtu.be/k9jemw3SZe0?si=93sq4N5-AjF-oVhy
	Knapsack Problem	https://youtu.be/-Cg-aL1D8CM?si=MSMQTKSaPqcNuZME
Unit-III	Sum of subsets	https://youtu.be/yDjadhjQ3eE?si=-6NQH4xIHYqemNp6
	Traveling Salesman Problem	https://youtu.be/-cLsEHP0qt0?si=-asPYE1zbCTMokLK
Unit-IV	Cook's theorem	https://youtu.be/qpCvPS-WwGA?si=CswYDncPrmCi3b_W
	NP Complete Problems	https://youtu.be/id7k6gUkZ8Y?si=fCSY5t-XMgUKzPi1

Course Code	**ECE-002A**				
Category	Professional Core Courses				
Course Title	**Mobile and Wireless Communications**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce wireless and mobile communication concepts, architectures, protocols, and technologies. • To develop understanding of wireless transmission, MAC protocols, mobility management, and networking mechanisms. • To familiarize students with cellular, WLAN, Bluetooth, WiMAX, satellite, and mobile Internet technologies. • To develop the ability to apply and analyze protocols and techniques for mobile and wireless communication systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define wireless communication concepts, protocols, architectures, and mobile networking technologies.	Level 1: Remember
CO2	Explain wireless transmission, MAC protocols, mobility management, transport protocols, and wireless architectures.	Level 2: Understand
CO3	Apply wireless and mobile networking concepts, protocols, routing techniques, and mobility mechanisms to communication scenarios.	Level 3: Apply
CO4	Analyze wireless, mobile, ad hoc, satellite, and application-layer technologies for effective communication and mobility support.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Application, History, Market Scenario, Reference Model and Overview, Wireless Local Loop and Cellular system. **Wireless Transmission:** Frequencies, Signals, Antennae, Signal Propagation, Multiplexing, Modulation, Spread Spectrum. **MAC Layer:** Specialized MAC, SDMA, FDMA, TDMA – Fixed TDM, Classical ALOHA, Slotted, ALOHA, CSMA, DAMA, PKMA, Reservation TDMA. Collision Avoidance, Polling, Inhibit Sense Multiple Access, CDMA. **Broadcasting:** Unidirectional Distribution Systems, Digital Audio Broadcasting, Digital Video Broadcasting, Convergence of Mobile and Broadcasting Techniques.

Unit-II

GSM: Mobile Services, Architecture Radio, Interface, Protocol, Localization, Calling Handover, Security, New data services. **Wireless LAN:** IEEE 802.11- System and Protocol Architecture, Physical Layer, MAC Layered Management.

Bluetooth: User scenarios, Physical layer, MAC Layer, Networking, Security and Link Management. Wimax.

Unit-III

Mobile Network Layer: Mobile IP-Goals, Assumptions, Requirement, Entities, Terminology, IP Packet delivery, Agent Advertisement and Discovery, Registration, Tunneling, Encapsulation, Optimization, Reserve Tunneling, Security, IPv6, DHCP. **Mobile Adhoc Networks:** Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Hierarchical algorithms, Performance Metrics. **Mobile Transport Layer:** Traditional TCP, Indirect TCP, Snooping, TCP, Mobile TCP, Fast retransmission TCP, Transaction oriented TCP.

Unit-IV

Satellite Systems: History, Applications, GEO, LEO, MEO, Routing, Localization, Handover in Satellite System. **Support for Mobility:** File System, WWW, HTML, System Architecture. **WAP:** Architecture, Wireless Datagram, Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Application Environment, Telephony Applications.

Suggested Readings:

1. Mobile Communication by Jochen Schiller, Pearson Education, 2002.
2. Mobile Cellular Telecommunications by Lee, McGRAW-Hill, 2nd Edition.
3. Wireless Communications by Theodore S Rappaport, Pearson Education.

Useful Video links:

Unit No.	Topic	Link
Unit-I	ALOHA	https://www.youtube.com/watch?v=sx0UPzztC5o&t=2590s
	Cellular Networks	https://youtu.be/2d26QaZVSo4?si=jNZDorTTuehmNyMN
Unit-II	GSM	https://youtu.be/bur9hq_abog?si=kktZLezRoQ2pLBSe
	IEEE 802.11	https://youtu.be/pnunzdvezto?si=muPXzFqj-8LUMEmg
Unit-III	Mobile IP	https://youtu.be/0QLRULNfbFg?si=QRfYyDxQeiHDYTzo
	Mobile Adhoc Networks	https://youtu.be/aWDE42pvZMc?si=58D0-RmD57hdz--q
Unit-IV	Satellite Communication Systems	https://youtu.be/dt4Ce8gQPns?si=uhEvOTynVWu_GirB
	LEO	https://youtu.be/Kf9cmrBtE40?si=I2Vl4d78Gz-Lw4Vy

Course Code	**AI-L301A**				
Category	Professional Core Courses				
Course Title	**Machine Learning Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: • To understand and implement basic machine learning algorithms for classification and prediction tasks. • To apply clustering and recommendation techniques for pattern discovery and personalized suggestions. • To perform dimensionality reduction and optimization using PCA and Gradient Descent techniques. • To develop and evaluate advanced machine learning models using Artificial Neural Networks (ANN).				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand the fundamental concepts of machine learning, including types of learning, basic algorithms, and model building techniques.	Level 2: Understand
CO2	Apply machine learning algorithms to implement solutions for classification, regression, and clustering problems using appropriate techniques.	Level 3: Apply
CO3	Apply data preprocessing, feature selection, and dimensionality reduction techniques for effective data analysis and model improvement.	Level 3: Apply
CO4	Analyze the performance of machine learning models using evaluation metrics and optimize models for better accuracy and efficiency.	Level 4: Analyze

List of Experiments:

Sr. No.	**Contents**	**COs**
1	Study the basic concepts of Machine Learning.	CO1
2	Write a program to implement Linear Regression for predicting continuous target values based on given input features.	CO2
3	Write a program to implement Logistic Regression for binary classification of a dataset.	CO2
4	Write a program to implement K-Nearest Neighbors (KNN) algorithm for classification problems.	CO2
5	Write a program to implement Decision Tree classifier for predicting outcomes based on input data.	CO3
6	Write a program to implement Random Forest algorithm for classification and regression tasks.	CO4
7	Write a program to implement Support Vector Machine (SVM) for classification of data points.	CO3
8	Write a program to implement Naive Bayes classifier for text or categorical data classification.	CO3

9	Write a program to implement K-Means clustering algorithm for grouping similar data points.	CO3
10	Write a program to implement Principal Component Analysis (PCA) for dimensionality reduction.	CO3
11	Write a program to implement Gradient Descent algorithm for optimizing a machine learning model.	CO4
12	Write a program to implement Artificial Neural Network (ANN) for classification or prediction tasks.	CO4
13	Write a program to implement a Recommender System using collaborative filtering technique.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Useful Video Links:

Experiment Name	**Virtual Lab Link**
Implement Random Forest for Multi-Class Classification	https://www.youtube.com/watch?v=5ONlGP0Nx3Q
Gradient Descent	https://www.youtube.com/watch?v=JA5rIxOve20
Principal Component Analysis (PCA)	https://www.youtube.com/watch?v=hkCT-6KJAK0
K-Means Clustering	https://www.youtube.com/watch?v=oFr4JX75MCc

<table>
<tr><td>Course Code</td><td colspan="5">AI-L303A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Fuzzy Logic and Soft Computing Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To understand fuzzy logic concepts and neural network fundamentals.
● To apply MATLAB tools for fuzzy systems and neural network implementation.
● To analyze learning algorithms and pattern classification techniques.
● To evaluate the performance of fuzzy inference and neural network models.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Understand fuzzy set operations, membership functions, and basic neural network concepts using MATLAB implementations.	Level 2: Understand
CO2	Apply fuzzy logic operations, FIS tools, and neural network models to solve computational problems using MATLAB.	Level 3: Apply
CO3	Apply MATLAB tools and neural network techniques to design FIS editors, HebbNet models, and associative neural networks.	Level 3: Apply
CO4	Analyze learning algorithms such as Hebbian learning, perceptron learning, and backpropagation for pattern storage and classification tasks..	Level 4: Analyze

List of Experiments

Sr. No.	Content	COs
1	Study the basics of Fuzzy logic and Soft Computing.	CO1
2	Write a program in MATLAB to perform Union, Intersection and Complement operations.	CO2
3	Write a program in MATLAB to implement De-Morgan’s Law.	CO2
4	Write a program in MATLAB to plot various membership functions.	CO2
5	Write a program to implement FIS Editor.	CO3
6	Generate ANDNOT function using McCulloch-Pitts neural net by MATLAB program.	CO3
7	Write a MATLAB program for Perceptron net for an AND function with bipolar inputs and targets	CO2

8	Write a M-file to calculate the weights for the following patterns using hetero associative neural net for mapping four input vectors to two output vectors	CO2
9	Write an M-file to store vector [-1 -1 -1 -1] and [-1 -1 1 1] in an auto-associative net. Find weight matrix. Test the net with [1 1 1 1] as input.	CO2
10	Find weight matrix and bias of HebbNet to classify two-dimensional input patterns.	CO3
11	Generate XOR function using back propagation algorithm.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
MATLAB Programming for Numerical Computation	https://youtu.be/IuEOMyGuuIg?si=F5_Wr1ojbsbujdsL
De Morgan's Laws	https://youtu.be/I8WdCozPTeQ?si=XuPBtzShDueSLvTa
McCulloch-Pitts neural net	https://youtu.be/UN3PqUjSoNQ?si=B-sameTHUWq3lzpz

Course Code	**AI-L305A**				
Category	Professional Core Courses				
Course Title	**Pattern Recognition Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop understanding of pattern representation and distance measures. • To provide practical exposure to pattern classification techniques. • To develop skills in dimensionality reduction and clustering. • To develop analytical skills for evaluating pattern recognition.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain pattern representation and distance measures through computational experiments.	Level 2: Understand
CO2	Apply classification techniques to pattern recognition problems.	Level 3: Apply
CO3	Apply dimensionality reduction and clustering techniques to pattern datasets.	Level 3: Apply
CO4	Analyze the performance of pattern recognition techniques.	Level 4: Analyze

List of Experiments

S. No.	Content	COs
1.	Study the basic concepts of pattern recognition.	CO1
2.	Write a Python program to represent patterns as feature vectors and visualize a two-dimensional feature space.	CO2
3.	Write a Python program to compute Euclidean, Manhattan, and Mahalanobis distances between patterns.	CO2
4.	Implement Nearest Neighbour and K-Nearest Neighbour classifiers for pattern classification.	CO2
5.	Implement a Bayes classifier for a two-class pattern classification problem.	CO2
6.	Implement pattern classification using Gaussian distributions and discriminant functions.	CO2
7.	Apply Principal Component Analysis (PCA) for dimensionality reduction and visualize the reduced feature space.	CO3
8.	Apply Linear Discriminant Analysis (LDA) for dimensionality reduction and classification.	CO3
9.	Implement K-means clustering for grouping patterns in a dataset.	CO3
10.	Implement agglomerative hierarchical clustering using single-linkage and complete-linkage methods.	CO3
11.	Compare the performance of selected classifiers using confusion matrix, accuracy, precision, recall, and F1-score.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	Virtual Lab Link
Introduction to Pattern Recognition	https://youtu.be/mfePdDh9t6Q?si=MBIBWQ9bFUz4oUvn
Feature Representation	https://cse20-iiith.vlabs.ac.in/exp/feature-representation/
Data Clustering: K-Means, MST-based	https://cse20-iiith.vlabs.ac.in/exp/mst-based/
Generation of Random Variables	https://cse20-iiith.vlabs.ac.in/exp/generation-of-random-variables/

Course Code	**CSE-L305A**				
Category	Professional Core Courses				
Course Title	**Design and Analysis of Algorithms Lab Using C++**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop understanding of algorithm design techniques and complexity analysis. • To provide practical exposure to sorting and graph algorithms. • To develop skills in greedy, dynamic programming, and backtracking techniques. • To develop analytical skills for evaluating algorithm performance.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain algorithm design techniques and complexity concepts.	Level 2: Understand
CO2	Apply divide-and-conquer and graph algorithms to computational problems.	Level 3: Apply
CO3	Apply greedy, dynamic programming, and backtracking techniques to optimization problems.	Level 3: Apply
CO4	Compare the performance of selected algorithms for computational problems.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Study the basic concepts of algorithm design and analysis of algorithms.	CO1
2	Write a C++ Program to perform Quick Sort using Divide & Conquer Technique.	CO2
3	Write a C++ program to perform Merge Sort using Divide and Conquer technique and compare its performance with Quick Sort for different input sizes.	CO2 CO4
4	Write a C++ program to find all-pairs shortest paths using the Floyd–Warshall algorithm and compare its performance with Dijkstra's algorithm for suitable graphs.	CO2 CO4
5	Write a C++ Program to solve the Knapsack Problem using Greedy Approach.	CO3
6	Write a C++ Program for Shortest Path using Dijkstra's Algorithm.	CO2
7	Write a C++ Program to find Minimum Spanning Tree using Prim's Algorithm.	CO2

8	Write a C++ Program for Sum of Subsets Problem using Back Tracking.	CO3
9	Write a C++ Program to solve Travelling Sales Problem using the Dynamic Programming Approach.	CO3
10	Write a C++ program to solve the N-Queen Problem using Backtracking and analyze the effect of increasing board size on execution time.	CO3 CO4
11	Write a Program to Check whether a given graph is connected or not using DFS method.	CO2

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Write a C++ Program to perform Quick Sort using Divide & Conquer Technique.	https://ds1-iiith.vlabs.ac.in/exp/quick-sort/quick-sort/index.html
Write a C++ Program for Shortest Path using Dijkstra's Algorithm.	https://ds2-iiith.vlabs.ac.in/exp/dijkstra-algorithm/index.html
Write a C++ Program to find Minimum Spanning Tree using Prim's Algorithm.	https://ds2-iiith.vlabs.ac.in/exp/min-spanning-trees/index.html

<table>
<tr><td>Course Code</td><td colspan="5">PT-301A</td></tr>
<tr><td>Category</td><td colspan="5">Practical Training</td></tr>
<tr><td>Course Title</td><td colspan="5">Practical Training-I*</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are to
Develop practical skills using industry-standard software tools and technologies.
Apply software engineering practices and technical documentation in real-world projects.
Enhance professional communication, teamwork, time management, and ethical practices.
Analyze and solve real-world computing problems using appropriate tools and methodologies.</td></tr>
<tr><td>Assessment</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain industry practices, coding standards, and software development processes.	Level 2: Understand
CO2	Apply computing knowledge and programming skills to solve practical problems.	Level 3: Apply
CO3	Demonstrate effective communication, teamwork, professional ethics, and time management.	Level 3: Apply
CO4	Analyze real-world computing problems and formulate appropriate solutions using collaborative and systematic approaches.	Level 4: Analyze
CO5	Evaluate the application of theoretical concepts, modern technologies, and innovative methodologies to solve practical computing challenges.	Level 5: Evaluate
CO6	Utilize industry-standard tools, frameworks, platforms, and development methodologies for the design, implementation, testing, and deployment of software solutions.	Level 6: Create

Note:

1. Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the V semester.
2. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

<table>
<tr><td>Course code</td><td colspan="6">CSE-301A</td></tr>
<tr><td>Category</td><td colspan="6">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Computer Networks</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE 5th Semester)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The objectives of this course are
To provide fundamental knowledge of computer networking concepts, architectures, communication models, and transmission techniques.
To develop understanding of networking protocols, addressing methods, routing mechanisms, and network services across different layers.
To enable students to apply networking principles and protocols for data communication and problem solving in computer networks.
To develop analytical understanding of network performance, congestion control, QoS, Networking technologies, and security mechanisms.</td></tr>
<tr><td>Assessment</td><td colspan="6">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="6">60 Marks</td></tr>
<tr><td>Total</td><td colspan="6">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="6">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts, models, protocols, devices, services, techniques, and security mechanisms of computer networks.	Level 1: Remember
CO2	Explain the principles, operations, functionalities, and interactions of computer networking components, protocols, architectures, and services.	Level 2: Understand
CO3	Apply networking concepts, protocols, algorithms, addressing methods, and security techniques to solve computer networking problems.	Level 3 : Apply
CO4	Analyze network performance, routing, QoS, congestion control, and security mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Data communication, Components, Computer networks and its historical development, distributed processing, network performance metrics (bandwidth, throughput, delay, jitter and packet loss), Internet Network **Models:** OSI model and TCP/IP Model.
Physical Layer: physical layer functions, Data Representation, Simplex, Half Duplex and Full Duplex Transmission, Modulation and Multiplexing, Packet and circuit switching, Transmission media, Topologies, connectionless and connection-oriented services.
Data Link Layer: Data link layer functions and services, MAC Addressing, Framing, flow control, error detection and correction (parity check, checksum, CRC and Hamming code), Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Unit-II

Medium Access Control: MAC layer functions, Random access, Controlled Access and channelization protocols, CSMA/CD and CSMA/CA.

Network Layer: Network layer functions and services, Logical addressing, IPv4 classful and classless addressing, subnetting, NAT, IPv4, ICMPv4, ARP, RARP and BOOTP, IPv6, IPv6 addressing, DHCP.
Network Devices: Repeater, hub, switch, router and gateway.

Unit-III

Routing Algorithms: Introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State and Distance Vector Routing.
Transport Layer: Transport layer functions and services, Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management.
Application Layer: Application layer functions and services, Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP.

Unit-IV

Congestion Control, Quality of Service, QoS parameters and QoS Improving techniques.
LAN and Wireless Networks: Ethernet, Wireless LAN (IEEE 802.11), Wi-Fi architecture, Token Bus, Token Ring, MAN Architecture- DQDB, WAN Architectures- Frame Relay, ATM, SONET/SDH
Network Security: Firewalls, security goals, types of attack, Introduction to cryptography, Types of ciphers: symmetric and asymmetric key ciphers.

Suggested Readings:

1. Data Communication and Networking by Behrouz A. Forouzan, 4th Edition, McGraw-Hill.
2. Data and Computer Communication by William Stallings, 8th Edition, Pearson Prentice Hall India.
3. Computer Networks by Andrew S. Tanenbaum, 8th Edition, Pearson New International Edition.
4. Internetworking with TCP/IP by Douglas Comer, Volume 1, 6th Edition, Prentice Hall of India.
5. TCP/IP Illustrated by W. Richard Stevens, Volume 1, Addison-Wesley, United States of America.

Useful Video Links

Unit No.	Topics	Links
Unit-I	Introduction to Computer Networks	https://www.youtube.com/watch?v=lnU-Zw3NEEQ
	OSI Model and TCP/IP Model	https://youtu.be/zzXs0EnCin0
	Packet Switching and Circuit Switching	https://youtu.be/29Qdz0FmvmQ?si=Yedvul4uJzmfkDsh
Unit-II	Medium Access Control Protocols	https://youtu.be/sx0UPzztC5o?si=VDg2wx1B68gvenjU
	Network Layer Introduction	https://youtu.be/aP346youQOk?si=6DRTU5dc1t21Dk_D
Unit-III	Routing Algorithms	https://youtu.be/AmlOSGYkKXc?si=87eNMi6RPeTd0FkL
	Transport Layer – TCP and UDP	https://youtu.be/EqzDTO9tdqs?si=16VZZu9Oz3IzOeOA
Unit-IV	Congestion Control and QoS	https://nptel.ac.in/courses/106105081
	SDH/SONET Layering, Frame Structure	https://youtu.be/f5EmFoXlYyQ?si=8ilxCANj5flH7TP4

Course Code	**CSE-315A**				
Category	Professional Elective Courses				
Course Title	**Data Warehouse and Mining**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V(Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the fundamentals of data warehousing and data mining. ● To provide knowledge of data mining techniques for pattern discovery and classification. ● To familiarize students with clustering methods and web data mining concepts. ● To develop understanding of techniques and tools for knowledge discovery from large datasets.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define concepts and terminology related to data warehousing and data mining.	Level 1: Remember
CO2	Explain data mining techniques, algorithms, and knowledge discovery processes.	Level 2: Understand
CO3	Apply data warehousing and data mining methods to extract useful patterns from data.	Level 3: Apply
CO4	Analyze data mining models, clustering techniques, and web mining approaches for knowledge discovery.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Data warehousing: Introduction, Operational data stores, ETL, Data warehouses – design guidelines for data warehouse implementation, Data warehouse metadata; OLAP – introduction, Characteristics, Multidimensional view and data cube, Data cube operations.

Unit-II

Data mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation(FP, growth), performance evaluation of algorithms.

Unit-III

Classification: Introduction, decision tree, tree induction algorithm – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method;

classification software, software for association rule mining; case study; KDD Insurance Risk Assessment.

Unit-IV

Cluster analysis: Introduction, partitional methods, hierarchical methods, and density based methods, dealing with large databases, cluster software.
Web Data Mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

Suggested Readings:

1. Data mining concepts and techniques by Han J., Kamber M. and Pei J., Morgan Kaufmann Publishers (2011) 3rd ed.
2. Data Mining by Pudi V., Krishana P.R., Oxford University press, (2009) 1st ed.
3. Data mining by Adriaans P., Zantinge D., Pearson education press (1996), 1st ed.
4. Data Warehousing Fundamentals by Pooniah, Willey interscience Publication, (2001), 1st ed.

Useful Video links:

Unit No.	Topics	Links
Unit-I	Operational data stores	https://youtu.be/Pd8VqYxNCf8?si=NShU4PrqvsM-Es_K
	OLAP	https://youtu.be/m-aKj5ovDfg?si=8A173Dujxn2OHbIL
Unit-II	Classification	https://youtu.be/VsYKqOokgaE?si=tNlEdtUANGMbrEuU
	Apriori algorithm	https://youtu.be/hEQkqpmtx-Y?si=HlMVIMDBWBhvBegT
Unit-IV	Cluster analysis	https://youtu.be/VcPWL9Nlozs?si=Jpshn_ax7FBsQaTH
	Density based methods	https://youtu.be/E_SdiZQ23xI?si=hupzFk1EjSNbge4q

Course code	**AI-307A**				
Category	Professional Elective Courses				
Course title	**DevOps Overview**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce software development processes, Agile methodologies, and DevOps principles. • To provide knowledge of continuous integration, continuous delivery, and application deployment practices. • To familiarize with the CAMS framework, infrastructure automation, and application containerization. • To present DevOps tools, monitoring techniques, and contemporary DevOps applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define software development models, Agile methodologies, DevOps concepts, and the CAMS framework.	Level 1: Remember
CO2	Explain Agile practices, DevOps workflows, continuous integration, continuous delivery, and infrastructure automation.	Level 2: Understand
CO3	Apply DevOps principles, automation practices, and deployment techniques to software development.	Level 3: Apply
CO4	Analyze DevOps workflows, containerization, monitoring approaches, and modern software delivery practices.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Traditional Software development Processes: The Advent of Software Engineering, Waterfall model and other development models, Developers vs IT Operations conflict.

Unit-II

AGILE Methodologies: Agile movement in 2000, Agile Vs Waterfall Method, Iterative Agile Software Development, Individual and team interactions over processes and tools, Working software over, comprehensive documentation, Customer collaboration over contract negotiation, Responding to change over following a plan.

Unit-III

DevOps Overview: Definition and Introduction to DevOps - DevOps and Agile, Purpose of Devops- Minimum Viable Product, Application Deployment, Continuous Integration, Continuous Delivery.

Unit-IV

CAMS (Culture, Automation, Measurement and Sharing): Culture, Automation, Measurement, Sharing, Test-Driven Development, Configuration Management, Infrastructure Automation, Root Cause Analysis, Blamelessness, Organizational Learning, REST API, GraphQL, HTTP/2, Application Containerization, DevOps Tools, Monitoring Tools; Recent applications / Case Studies of DevOps.

Suggested Readings:

1. The DevOps Handbook by Gene Kim, Jez Humble, Patrick Debois, and John Willis, O'Reilly Publishers.
2. What is DevOps? by Mike Loukides, O'Reilly Media.
3. Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale by Jennifer Davis and Ryn Daniels, O'Reilly Publishers.
4. Practical DevOps by Joakim Verona, O'Reilly Publishers.
5. Building a DevOps Culture by M. Walls, O'Reilly Publications, 2013.
6. Dev Ops for Beginners: Dev Ops Software Development Method guide for software developers and IT professionals by J. Joyner, Mihails Konoplovs, 2015.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Traditional Software development Processes	https://youtu.be/Ln_LP7c23WM?si=5sRhM-2qv78ODry2
	Developer vs Operations	https://youtu.be/OJW409Dkpvg?si=DMeXWBsY47EDfVzE
Unit-II	Agile Development	https://youtu.be/jRs-aFETAXY?si=VeP4MjVbtLRX7WL3
	Customer collaboration over contract negotiation	https://youtu.be/U0U2yS87WEA?si=sEKdug_8jsU7-SWP
Unit-III	Introduction to DevOps	https://youtu.be/2N-59wUIPVI?si=bDihv1hfiwHaeYSU
	DevOps and Agile	https://youtu.be/Hv4QGbvrEio?si=4h-O7YX1y2zphPwO
Unit-IV	REST API	https://youtu.be/qVTAB8Z2VmA?si=oRzqITCSxvSCfgF4
	Test Driven Development	https://youtu.be/qkblc5WRn-U?si=DMJvDyt55nqERTIl

Course code	**AI-309A**				
Category	Professional Elective Courses				
Course title	**AI Ethics and Responsible AI**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To provide knowledge of ethical principles, governance frameworks, and societal impacts of AI systems. ● To develop understanding of fairness, transparency, privacy, accountability, and responsible AI practices. ● To enable application of ethical frameworks and responsible AI guidelines in AI development. ● To develop analytical abilities for evaluating ethical, legal, and societal implications of AI technologies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define AI ethics concepts, responsible AI principles, governance frameworks, fairness, transparency, and accountability mechanisms.	Level 1: Remember
CO2	Explain ethical challenges, societal impacts, privacy concerns, bias issues, and regulatory aspects of AI systems.	Level 2: Understand
CO3	Apply responsible AI principles, ethical guidelines, and governance frameworks in AI applications.	Level 3: Apply
CO4	Analyze AI systems with respect to fairness, bias, transparency, privacy, accountability, and societal impact.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Ethics of AI, Benefits & risks of artificial intelligence, The singularity, Three Major Singularity Schools, Responsible and safe AI systems: The value alignment problem, Principles for creating safer AI, Algorithmic bias: From discrimination discovery to fairness-aware data mining.

Unit-II

AI and State: Data, Individuals, and Society: Individuals and society, Fairness and bias, ethics, legality, data collection and public use, Democracy Killer robots, Love Robots, Automation, Self Driving cars, Robots rights, Living with Alien minds, Self-consciousness and super intelligence, Case Study: Rethinking AI Ethics with Data Activism.

Unit-III

AI and Business: Word Embeddings, facial recognition, prediction algorithm, Disinformation, overfitting, causation vs correlation, Fairness in facial recognition, natural language processing, Case study: Algorithmic Transparency in the Public Sector, Law and Regulation of AI: Global Perspective.

Unit-IV

AI and Society: Applications, Challenges and Opportunities Understand conceptions of global governance, corporate social responsibility, decision making under risk, and market failures to investigate issues of global justice raised by AI.
Case Study: AI and Nigeria- Exploring Threats to Human Rights, AI Ethics in the LAC Region.
Principles of Responsible AI: Fairness, Reliability, Safety, Inclusiveness, Accountability, Sustainable and green AI, Responsible deployment of Generative AI and LLMs.

Suggested Readings:

1. Superintelligence: Paths, Dangers, Strategies by N. Bostrom, Oxford University Press, 2014.
2. Moral Machines by Wallach, W., Allen, C., Oxford University Press, 2008.
3. The ethics of artificial intelligence by N. Bostrom and E. Yudkowsky, Cambridge University Press, Cambridge, 2014.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to AI Ethics	https://www.youtube.com/watch?v=mmrlkO4vpts
	Responsible and safe AI systems: The value alignment problem	https://youtu.be/phBqlIwJxNQ?si=UJSaa0WlqBoPiAn7
Unit-II	Principles, Governance and Regulation	https://www.youtube.com/watch?v=i8aDSaA-srQ
Unit-III	AI Bias and Fairness	https://www.youtube.com/watch?v=wmyVODy_WD8
Unit-IV	AI and Nigeria: Exploring Threats to Human Rights	https://www.youtube.com/watch?v=iii14nWRz38

Course code	**AI-001A**				
Category	Professional Core Courses				
Course title	**Neural Networks**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE-AIML/CSE-DS)**
	3	1	0	**4**	
Course Objectives	The objectives of this course are ● To provide knowledge of artificial neural networks, neuron models, architectures, and activation functions. ● To develop understanding of neural network learning mechanisms and computational models. ● To enable application of neural network techniques for pattern recognition and problem solving. ● To develop analytical abilities for evaluating neural network performance and learning behaviour.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define artificial neural network concepts, neuron models, activation functions, architectures, and learning paradigms.	Level 1: Remember
CO2	Explain neural network structures, learning algorithms, associative memories, and training mechanisms.	Level 2: Understand
CO3	Apply neural network models and learning techniques to solve classification, prediction, and pattern recognition problems.	Level 3: Apply
CO4	Analyze neural network performance, learning behaviour, memory models, and training outcomes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Overview of biological neurons: Structure of biological neuron, neurobiological analogy, Biological neuron equivalencies to artificial neuron model, Evolution of neural network.
Activation Functions: Threshold functions, Signum function, Sigmoid function, Tan-hyperbolic function, Stochastic function, Ramp function, Linear function, Identity function.
ANN Architecture: Feed forward network, Feed backward network, single and multilayer network, fully recurrent network.

Unit-II

McCulloch and Pits Neural Network (MCP Model): Architecture, Solution of AND, OR function using MCP model.
Hebb Model: Architecture, training and testing, Hebb network for AND function.

Perceptron Network: Architecture, training, Testing, single and multi-output model, Perceptron for AND function Linear function, application of linear model, linear separability, solution of OR function using linear separability model.

Unit-III

Learning: Supervised, Unsupervised, reinforcement learning, Gradient Decent algorithm, generalized delta learning rule, Habbian learning, Competitive learning.
Back propogation Network: Architecture, training and testing.

Unit-IV

Associative memory: Auto associative and Hetero associative memory and their architecture, training (insertion) and testing (Retrieval) algorithm using Hebb rule and Outer Product rule. Storage capacity, Testing of associative memory for missing and mistaken data, Bidirectional memory.

Suggested Readings:

1. Neural Networks: A Comprehensive formulation by Simon Haykin, AW, 1998.
2. Neural Networks by Kosko, PHI, 1992.
3. Neural Network Fundamentals by N.K. Bose, P. Liang, T.M.H, 2002.
4. Neural Network by T.N.Shankar, University Science Press.
5. Neuro Fuzzy Systems by Lamba, V.K., University Science Press.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Artificial Neural Networks	https://youtu.be/xbYgKoG4x2g?si=iG_Ygz7pTJuCEhIt
	Biological and Artificial Neural Network	https://www.youtube.com/watch?v=0aDq6ax6kGQ
Unit-II	Perceptron	https://youtu.be/tRG-OnnQ9g4?si=vE-g2Xx3ldWghw3R
	Solution of Non-Linearly Separable Problems	https://youtu.be/Fp33mf3L6AE?si=busfaI5LzLX3QZt9
Unit-III	Learning Mechanisms Hebbian,Competitive	https://youtu.be/Zxs-f4HsTDk?si=1YbrAuv_mQaAwAOM
Unit-IV	Associative memory	https://youtu.be/Ccrw9L1DK4g?si=3KIdlhOk3jZQUmWh

Course code	**AI-302A**				
Category	Professional Core Courses				
Course title	**Recommender Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of recommender system concepts, architectures, similarity measures, and recommendation techniques. • To develop understanding of content-based, collaborative, and trust-based recommendation methods. • To enable application of recommender system techniques for personalized information retrieval. • To develop analytical abilities for evaluating recommendation quality and system effectiveness.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define recommender system concepts, architectures, similarity measures, filtering techniques, and evaluation metrics.	Level 1: Remember
CO2	Explain content-based, collaborative, knowledge-based, and trust-based recommendation approaches.	Level 2: Understand
CO3	Apply recommendation techniques, similarity measures, and filtering algorithms to develop personalized recommendation systems.	Level 3: Apply
CO4	Analyze recommender systems using evaluation strategies, trust models, dimensionality reduction techniques, and recommendation performance measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Recommender Systems: Introduction and basic taxonomy of recommender systems – Traditional and non-personalized Recommender Systems, Overview of data mining methods for recommender systems, similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD), Applications of recommendation systems, Issues with recommender system: The cold-start problem.

Unit-II

Content-based Recommender System: Architecture of Content-based Systems, Advantages and Drawbacks of Content-based Filtering, Content representation and content similarity, Item profiles, discovering features of data, obtaining item features from tags, representing item profiles, Learning User Profiles and Filtering, Similarity-based

retrieval, Classification algorithms, Knowledge base recommendation: Knowledge representation and reasoning, constraint-based recommenders, Case based recommenders.

Unit-III

Collaborative filtering-based Recommender System: Understanding ratings and rating data, User-based nearest-neighbor recommendation: Similarity Function, User-Based Algorithms Item-based nearest neighbour recommendation: Similarity Function, Item-Based Algorithms, Further model-based and preprocessing-based approaches, Comparing User-Based and Item-Based recommendations.

Unit-IV

Evaluating Recommender Systems: Introduction, General properties of evaluation research, popular evaluation designs, Evaluation on historical datasets, Alternate evaluation designs. Community-Based Web Search- The Collaborative Web Search System. Shared Web Search - The HeyStaks System, The HeyStaks Recommendation Engine. Social Tagging Recommenders Systems- Folksonomy, The Traditional Recommender Systems Paradigm, BibSonomy as Study Case, Tag Acquisition, Trust and Recommendations- Introduction, Computational Trust, Trust-Enhanced Recommender Systems

Suggested Readings:

1. Recommender Systems: An Introduction by Jannach D., Zanker M. and FelFering A, Cambridge University Press, 1st ed., 2011.
2. Recommender Systems Handbook by Ricci F., Rokach L., Shapira D., Kantor B.P., Springer, 1st ed., 2011.
3. Building Recommendation Engines by Suresh Kumar Gorakala, Packt Publishing, 2016.
4. Recommender Systems: The Textbook by Aggarwal, C. C., Springer, 2016.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Overview of Recommender Systems	https://youtu.be/1JRrCEgiyHM?si=TI92GD7dKaLgUynP
	Dimensionality Reduction - Introduction	https://youtu.be/yLdOS6xyM_Q?si=IcKoxrbDJ4PVpRgy
Unit-II	Content Based Recommendations	https://youtu.be/2uxXPzm-7FY?si=5MOXAIK8XazWx5Em
Unit-III	Collaborative Filtering	https://youtu.be/h9gpufJFF-0?si=7hmFo4D9QimbfN6g
	Implementing Collaborative Filtering	https://youtu.be/6BTLobS7AU8?si=lUZLC1J8GfEiRG1y
Unit-IV	Evaluating Recommender Systems	https://youtu.be/VZKMyTaLI00?si=cQMi302X8yMgDLV5

<table>
<tr><td>Course Code</td><td colspan="5">CSE-002A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Big Data Analytics</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of big data concepts, architectures, storage models, and analytical frameworks.
To develop understanding of distributed computing, data processing, and big data technologies.
To enable application of big data tools and analytics techniques for large-scale data processing.
To develop analytical abilities for evaluating big data solutions and business insights.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define big data concepts, architectures, storage mechanisms, distributed computing models, and analytical frameworks.	Level 1: Remember
CO2	Explain big data processing techniques, distributed systems, analytical methods, and supporting technologies.	Level 2: Understand
CO3	Apply big data tools, frameworks, and analytics techniques for processing and analyzing large datasets.	Level 3: Apply
CO4	Analyze big data solutions, analytical outcomes, scalability issues, and performance considerations.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Introduction to Big Data: Big Data: Why and Where, Application and Challenges, Characteristics of Big Data and Dimensions of Scalability, The Six V, Approaches for Analysis of Big Data , Steps in the Data science process, Foundations for Big Data Systems and Programming, Distributed file systems, Role of Data analyst.

Unit II

Data Repositories and Big Data Platforms: RDBMS, NoSQL, Data Marts, Data Lakes, ETL, and Data Pipelines, Introduction to Hadoop Ecosystem, HDFS, Map-Reduce Programming, Understanding Text Analytics and Big Data, Predictive analysis on Big Data, Big Data Processing Tools, Modern Data Ecosystem, Key Players, Types of Data, Understanding Different Types of File Formats, Sources of Data Using Service Bindings.

Unit-III

Introduction to Big Data Modeling and Management: Data Storage, Data Quality, Data Operations, Data Ingestion, Scalability and Security Traditional DBMS and Big Data Management Systems, Real Life Applications, Data Model: Structure, Operations, Constraints, Types of Big Data Model.

Unit-IV

Big Data Integration and processing: Big Data Processing, Retrieving: Data Query and retrieval, Information Integration, Big Data Processing pipelines, Analytical operations, Aggregation operation, High level Operation, Tools and Systems: Big Data workflow Management.

Suggested Readings:

1. Big Data Analytics by Seema Acharya, Subhasini Chellappan, Wiley, 2015
2. Intelligent Data Analysis by Michael Berthold, David J. Hand, Springer, 2007.
3. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC press.
4. Using R to Unlock the Value of Big Data: Big Data by Tom Plunkett, Mark Hornick.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Big Data	https://youtu.be/r5k-_RLIpuA?si=YZ1tzhVmP55jhmWb
	Application and Challenges, Characteristics of Big Data	https://youtu.be/uhj5oKRqY6w?si=CRZtp1M08PBjKeCp
	The Six V, Data Science: Getting Value out of Big Data	https://youtu.be/mI4O4bG39Wo?si=JZndMD7amRilg1Kp
	Distributed file systems	https://youtu.be/0QIv4kk18Kg?si=l06ISSB1CsbyLdCi
Unit-II	RDBMS, NoSQL, Data Marts, Data Lakes	https://youtu.be/tqD8aVpbD8o?si=7-qLiRcdvOewtMWi
	Modern Data Ecosystem, Key Players, Types of Data	https://youtu.be/fBK_58JUICs?si=Y28CXZDcfy-Wz8ri
	Sources of Data Using Service Bindings	https://youtu.be/G3OwDpYTJPE?si=73Vts0aP2LzOVewl
Unit- III	Data Storage, Data Quality, Data Operations, Data Ingestion	https://youtu.be/0I2QB5Q0EaE?si=TCfP4ypw9QemQbPw
	Scalability and Security Traditional DBMS	https://youtu.be/EUzsy3W4I0g?si=HDz2Ah5zVgBeH62O
	Data Model: Structure, Operations	https://youtu.be/Z2Zx2G02aI4?si=DQttlY4tIZEolUPD
	Types of Big Data Model.	https://youtu.be/-xxCY6WHfRY?si=bdh8TVMHm-dgE2tV
Unit- IV	Big Data Processing	https://youtu.be/YEMGK4BPtHc?si=_7PfT1YWyrhd3Jic
	Retrieving: Data Query and retrieval, Information Integration	https://youtu.be/DJOaFa8xlrs?si=DulEAUkIEoJKgvy5
	Big Data Processing pipelines, Analytical operations	https://youtu.be/VtzvF17ysbc?si=mmbnnXQ7ZNAbTgvR
	Tools and Systems: Big Data workflow Management	https://youtu.be/Pyo4RWtxsQM?si=TXUQ-p45JnwEJTlL

Course Code	**AI-304A**				
Category	Professional Core Courses				
Course Title	**Reinforcement Learning**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand the basics of Reinforcement Learning and bandit algorithms. ● To analyze Markov Decision Processes and value-based methods. ● To apply Monte Carlo, TD learning, Q-learning, and Sarsa algorithms. ● To evaluate advanced Reinforcement Learning methods and function approximation**.**				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	**Skill Demonstrated**	**RBT Level**
CO1	Recall the basic concepts of Reinforcement Learning, stochastic bandits, Markov Decision Processes, and reward-based learning models.	Level 1: Remember
CO2	Explain the principles of action-value methods, UCB, Thompson Sampling, Bellman equations, and policy evaluation methods.	Level 2: Understand
CO3	Apply reinforcement learning algorithms to solve prediction, control, and decision-making problems in dynamic environments.	Level 3: Apply
CO4	Analyze the convergence, efficiency, and performance of model-based and model-free reinforcement learning techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Elements of Reinforcement Learning, Episodic vs Continuous Tasks, The Rewards Hypothesis, Cumulative Reward, Multi-armed Bandits: A k -armed Bandit Problem, Action-value Methods, The 10-armed Testbed, Optimistic Initial Values, Gradient Bandit Algorithms. Basics of probability and linear algebra, Definition of a stochastic multi-armed bandit, Definition of regret, Achieving sublinear regret, UCB algorithm, KL-UCB, Thompson Sampling.

Unit-II

Markov Decision Processes and Dynamic Programming: Markov Decision Problem, policy, and value function, Reward models (infinite discounted, total, finite horizon, and average), Episodic & continuing tasks, Bellman's optimality operator, and Value iteration &policy iteration.

Unit-III

Model-Based and Model-Free Reinforcement Learning: The Reinforcement Learning problem, prediction and control problems, Model-based algorithm, Monte Carlo methods for prediction, and Online implementation of Monte Carlo policy evaluation, Bootstrapping; TD(0) algorithm; Convergence of Monte Carlo and batch TD(0) algorithms; Model-free control: Q-learning, Sarsa, Expected Sarsa.

Unit-IV

Advanced Reinforcement Learning and Function Approximation: n-step returns; TD(λ) algorithm; Need for generalization in practice; Linear function approximation and geometric view; Linear TD(λ). Tile coding; Control with function approximation; Policy search; Policy gradient methods; Experience replay; Fitted Q Iteration; Case studies**.**

Suggested Readings:

1. Reinforcement learning: An introduction by Sutton, Richard S., and Andrew G.Barto, MIT press 2020.
2. Statistical reinforcement learning: modern machine learning approaches by First Edition, Sugiyama, and Masashi. CRC Press 2015.
3. Bandit algorithms by First Edition, Lattimore, T. and C. Szepesvari. Cambridge University Press. 2020.
4. Reinforcement Learning Algorithms: Analysis and Applications by Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021.
5. Deep Reinforcement Learning in Action by Alexander Zai and Brandon Brown, First Edition, Manning Publications 2020.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Elements of Reinforcement Learning	https://youtu.be/lfPEJPHUllg?si=ThR6fZ2vW81F9sMw
	Thompson Sampling	https://youtu.be/H2OWTxdauqA?si=qzAsejOCNospMrJG
Unit-II	Markov Decision Problem	https://youtu.be/Zs9MLJnSCWU?si=VvxlSis4TQfVdx3O
	Bellman's optimality operator	https://youtu.be/asWQWl59Krg?si=V94m6couFxKQZVZi
Unit-III	Monte Carlo methods for prediction	https://youtu.be/U7ckRk7g5j0?si=hNqFskD2kBz-TutP
	Expected Sarsa	https://youtu.be/hEUOXZNSRcQ?si=jky6z5mdH0nMaHTG
Unit-IV	TD(λ) algorithm	https://youtu.be/AldBTnsk-us?si=2DDgN3OY3gwC9mbz
	Fitted Q Iteration	https://youtu.be/AohtWrJwvgg?si=MifE6YSttzidU1S-

Course Code	**AI-L001A**				
Category	Professional Core Courses				
Course Title	**Neural Networks Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To introduce the MATLAB environment for designing and simulating neural network models. • To develop understanding of basic neuron models and learning rules such as McCulloch-Pitts and Hebbian learning. • To study and implement various activation functions used in neural networks. • To analyze the effect of weights, bias, and activation functions on neuron behavior. • To implement and evaluate neural network models for solving linearly separable problems and pattern recognition task.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the MATLAB environment and fundamental concepts of neural networks, including neuron models and activation functions.	Level 2: Understand
CO2	Implement basic neural network models such as McCulloch-Pitts, Hebbian learning, and activation functions using MATLAB.	Level 3: Apply
CO3	Apply neural network concepts to analyze the effect of weights, bias, and activation functions on neuron output.	Level 3: Apply
CO4	Analyze and solve linearly separable problems using Perceptron and Hopfield network models.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Study and explore the MATLAB environment for neural network design and simulation.	CO1
2	Write a program to plot and analyze various activation functions such as threshold, signum, sigmoid, tanh, ramp, and identity.	CO1 CO2
3	Implement the McCulloch-Pitts (MCP) neuron model with a suitable example.	CO2
4	Implement the Hebbian learning model and demonstrate its learning process with an example.	CO2
5	Write a program to study basic neuron models and learning algorithms using MATLAB Neural Network Toolbox	CO1 CO2
6	Write a program to study the effect of weights and bias values on the output of a neuron.	CO3
7	Write a program to analyze how different activation functions influence the output of a neuron.	CO3
8	Implement a neural network model to solve a linearly separable problem.	CO3 CO4

9	Write a program to store a pattern (1 1 1 0). Test the network using Discrete Hopfield Net by giving the input with mistakes in First and Second position.	CO4
10	Write a program for solving linearly separable problem using Perceptron Model.	CO3 CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Linearly separable problem using Perceptron Model.	https://cse22-iiith.vlabs.ac.in/exp/perceptron-learning/simulation.html
Test the network using Discrete Hopfield Net	https://cse22-iiith.vlabs.ac.in/exp/pattern-storage-task/simulation.html
Basic neuron models and learning algorithms using MATLAB Neural Network Toolbox.	https://cse22-iiith.vlabs.ac.in/exp/pattern-clustering/simulation.html

<table>
<tr><td>Course Code</td><td colspan="5">AI-L302A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Recommender Systems Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To understand the fundamentals of recommender systems, including content-based, collaborative filtering, hybrid recommendation, user profiling, and item profiling techniques
To explore Python libraries and preprocessing methods for loading, analyzing, cleaning, and visualizing datasets used in recommender systems.
To develop book-based, movie-based, collaborative filtering, and SVD-based recommendation models using Python.
To evaluate and improve recommendation performance using matrix factorization techniques and metrics such as RMSE, MAE, Precision, Recall, and F1-score.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify the concepts and techniques of recommender systems, including content-based, collaborative, hybrid recommendation, user profiling, and item profiling.	Level 2: Understand
CO2	Apply Python libraries and preprocessing methods to load, explore, visualize, and prepare datasets for recommender system development.	Level 3: Apply
CO3	Develop book-based, movie-based, collaborative filtering, and SVD-based recommender systems using Python.	Level 3: Apply
CO4	Analyze and evaluate recommender system performance using metrics such as RMSE, MAE, Precision, Recall, and F1-score.	Level 4: Analyze

List of Experiments:

Sr. No.	Content	COs
1	Study the basic concepts of Recommender Systems	CO1
2	Write a program to create a bar chart for the categories of various books along with their recommendations.	CO2
3	Write a program to familiarize students with loading, exploring, and preprocessing datasets required for recommender systems.	CO2
4	Write a program for content-based recommendation system in Python.	CO2
5	Write a program to create a book-based recommender system.	CO3
6	Write a program to create a movie-based recommender system..	CO3
7	Write a program for collaborative filtering using Python.	CO2

8	Write a program for SVD in Python for recommendation system.	CO3
9	Write a program to design and implement Hybrid recommender system.	CO2
10	Write a program to apply matrix factorization techniques like SVD for improving recommendation accuracy.	CO3
11	Write a program to show item profiling and user profiling in recommender system.	CO2
12	Write a program to calculate and interpret evaluation metrics such as RMSE, MAE, Precision, Recall and F1- score for assessing recommender system.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Basic Python Programming Concepts	https://python-iitk.vlabs.ac.in/Introduction.html
Collaborative filtering for recommendation systems in Python	https://youtu.be/z0dx-YckFko?si=tVfYnkM5_rRNacDA
Book Recommender System	https://www.youtube.com/watch?v=1YoD0fg3_EM

Course Code	**CSE-L002A**				
Category	Professional Core Courses				
Course Title	**Big Data Analytics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To provide knowledge of the Hadoop ecosystem, distributed computing, and big data processing frameworks. ● To develop understanding of MapReduce, Pig, and Hive for large-scale data analysis. ● To enable application of big data tools and techniques for solving data-intensive problems. ● To develop analytical abilities for evaluating big data processing methods and outcomes.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Explain Hadoop ecosystem components, distributed computing concepts, and big data processing frameworks. .	Level 2: Understand
CO2	Implement data processing solutions using Hadoop, MapReduce, Pig, and Hive.	Level 3: Apply
CO3	Apply big data techniques for data analysis, querying, filtering, and clustering.	Level 3: Apply
CO4	Analyze big data processing algorithms and evaluate their performance for large-scale datasets.	Level 4: Analyze

List of Experiments:

Sr. No.	**Contents**	**COs**
1	Study and configure Hadoop.	CO1
2	Implement Word Count using MapReduce.	CO2
3	Perform matrix multiplication using MapReduce.	CO2
4	Perform relational operations using Pig.	CO2
5	Perform database operations using Hive.	CO2
6	Implement Bloom Filter using MapReduce.	CO3
7	Find frequent item sets using MapReduce.	CO3
8	Implement clustering (K-Means) using MapReduce.	CO3
9	Implement PageRank algorithm.	CO4
10	Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.	CO4

Note: 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Perform relational operations using pig	https://youtu.be/9_Huva3VVAY?si=w-6ETum5NmaC1tea
Implement Bloom Filter using MapReduce.	https://youtu.be/bD0Xw4sR8kM?si=GCdGOkJXZ1utrs-w
Implement clustering (K-Means) using MapReduce.	https://youtu.be/-ok7BBx_D2Y?si=xLdACQP-s4ZTSpgM
Implement PageRank algorithm.	https://youtu.be/rKWozgedyI4?si=yZ7cySnM1N19f9YA

Course code	**CSE-303A**				
Category	Professional Elective Course				
Course title	**Formal Languages and Automata**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of automata, formal languages, grammars, and computational models. • To develop understanding of language recognition, parsing, and computational mechanisms. • To enable application of automata and grammar concepts for problem solving. • To develop analytical abilities related to computability, decidability, and complexity.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the concepts, models, grammars, languages, and computational theories related to formal languages and automata.	Level 1: Remember
CO2	Explain the principles, operations, and relationships among automata, grammars, languages, and computational models.	Level 2: Understand
CO3	Apply automata, grammars, and computational models to solve language recognition and processing problems.	Level 3: Apply
CO4	Analyze computational models, language classes, and decidability issues to evaluate computational problems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Nondeterministic finite automata (NDFA), Equivalence of DFA and NDFA, Conversion of NFA to DFA , minimization of finite automata, Finite automata with ϵ- moves, Acceptability of a string by a finite Automata.
Introduction to Machines: Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

Unit-II

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of regular expression, Regular expression conversion to Finite Automata and vice versa.
Properties of regular languages: Regular language, pumping lemma for regular sets/languages, Application of regular languages.

Unit-III

Grammars: Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal, Reduced Forms: Removal of useless symbols, null and unit productions.
Normal Form: Chomsky Normal form(CNF) and Greibach Normal Form(GNF), Push Down Automata: Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

Unit-IV

Turing machines: The basic model for Turing machines (TM), Deterministic and NonDeterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by designed turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.
Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Suggested Readings:

1. Theory of Computer Science: Automata, Languages and Computation by K. L. P. Mishra and N. Chandrashekaran, 2nd Edition, Prentice Hall of India, India, 2003.
2. Fundamentals of the Theory of Computation: Principles and Practice by Raymond Greenlaw and H. James Hoover, Morgan Kaufmann, 1998.
3. Introduction to Languages and Automata Theory by John C. Martin, 3rd Edition, Tata McGraw-Hill, 2007.
4. Introduction to Automata Theory, Languages, and Computation by John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, 3rd Edition, Pearson Education.

Useful Video Link:

Unit No	Topics	Links
Unit-I	Introduction to Automata, Languages and Computation	https://www.youtube.com/watch?v=_2w9UX17m_k&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=1
	Deterministic Finite Automata (DFA)	https://www.youtube.com/watch?v=CwihAY_fgRE&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=2
Unit-II	Regular expression	https://www.youtube.com/watch?v=OA8EY3HKZoc&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=17
	Pumping Lemma	https://www.youtube.com/watch?v=wQbdjmINxNU&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=28
Unit-III	Chomsky Normal Form (CNF)	https://www.youtube.com/watch?v=AnHE1jVpgHA&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=47
Unit-IV	Turning Machine	https://www.youtube.com/watch?v=WYncdAzKMHU&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=60

Course Code	**AI-306A**				
Category	Professional Elective Courses				
Course Title	**Explainable AI**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE-AIML/CSE-DS)**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To provide knowledge of explainable AI concepts, interpretability methods, and transparency mechanisms. ● To develop understanding of model explanation techniques and trustworthy AI practices. ● To enable application of explainability methods for interpreting AI models. ● To develop analytical abilities for evaluating transparency, fairness, and trustworthiness of AI systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define explainable AI concepts, interpretability methods, transparency principles, and trustworthy AI mechanisms.	Level 1: Remember
CO2	Explain model explanation techniques, interpretability approaches, and evaluation methods used in explainable AI.	Level 2: Understand
CO3	Apply explainability techniques to interpret machine learning and AI model behaviour.	Level 3: Apply
CO4	Analyze AI systems for transparency, interpretability, fairness, accountability, and trustworthiness.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Explainable AI: Science of Interpretable Machine Learning, Motivation, Challenges, and Mythos of Model Interpretability, Human Factors in Explainability, Interpreting Interpretability. Fundamentals of XAI, Categorization of XAI, Taxonomy of XAI methods for Machine Learning, Machine Learning interpretability, Causal model induction, Causality learning, XAI techniques and limitations.

Unit-II

Post hoc Explanations: Explaining the Predictions of Any Classifier, Pitfalls, Challenges, and Evaluation of Feature Attributions, LIME and SHAP, OpenXAI, The Disagreement Problem in Explainable Machine Learning, Counterfactual Explanations (or) Algorithmic Recourse, Learning Model-Agnostic Counterfactual Explanations for Tabular Data.

Unit-III

Attention and Concept Based Explanations: Quantifying Interpretability of Deep Visual Representations, Interpretability Beyond Feature Attribution, Data Attribution and Interactive Explanation, Equitable Valuation of Data, Explainable Active Learning (XAL), Theory of Explainability and Interpreting Generative Models.

Unit-IV

Explainability for Fair Machine Learning: Connections with Robustness, Privacy, Fairness, and Unlearning, Right to Explanation and the Right to be Forgotten, Fairness via Explanation Quality, Mechanistic Interpretability and Compiled Transformers, Understanding and Reasoning in Large Language Models.

Suggested Readings:

1. Explainable AI for Practitioners by Michael Munn, David Pitman, O'Reilly Media Inc., 2022.
2. Explainable AI with Python by Leonida Gianfagna, Antonio Di Cecco, Springer, 2021.
3. Interpretable Machine Learning, A Guide for Making Black Box Models Explainable by Christoph Molnar, Leanpub, 2023.
4. Hands-On Explainable AI (XAI) with Python: Interpret, visualize, explain, and integrate reliable AI for fair, secure, and trustworthy AI apps by Denis Rothman Packet Publishing Limited, 2020.
5. Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning by Uday Kamath and John Liu, Springer, ISBN 9783030833558.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Explainable AI	https://youtu.be/McviMUYiG9s?si=p5OVqjLWD-il9fl5
	Machine Learning interpretability	https://youtu.be/Rgscjp0qsmg?si=5UfNUsGA5d955l7m
Unit-II	LIME and SHAP	https://youtu.be/YZwDizPBFaM?si=TCPd-g71jKqUWe9L
	Counterfactual explanations	https://youtu.be/8r-1JBWBycQ?si=TmWJMCOu8BP4dA0_
Unit-III	Quantifying Interpretability of Deep Visual Representations	https://youtu.be/Xy6RcjXMa2c?si=4x977_uUEtERZXzw
Unit-IV	Reasoning in Large Language Models	https://youtu.be/6-tv6tEprVI?si=NRTHP-FQo9Xoo0D_

Course Code	**AI-308A**				
Category	Professional Elective Courses				
Course Title	**Swarm Intelligence**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● Introduce the fundamentals of swarm intelligence and metaheuristic optimization. ● Present the principles and variants of Ant Colony Optimization, Particle Swarm Optimization, and Artificial Bee Colony algorithms. ● Provide knowledge of swarm intelligence techniques for solving optimization problems. ● Familiarize learners with the applications of swarm intelligence in engineering and artificial intelligence.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	**Skills Demonstrated**	**RBT Level**
CO1	Define the concepts and principles of swarm intelligence.	Level 1: Remember
CO2	Explain the concepts of swarm intelligence, metaheuristics, and search strategies.	Level 2: Understand
CO3	Apply swarm intelligence algorithms to solve real-world optimization problems.	Level 3: Apply
CO4	Compare the performance of swarm intelligence algorithms for different optimization tasks.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Swarm Intelligence: Essence of an Algorithm, Algorithms and Self organization, Links between Algorithms and Self-Organization, Characteristics of Metaheuristics, Swarm Intelligence based algorithms – Ant Algorithms, Bee Algorithms, Particle Swarm Optimization and Krill Herd Algorithms, Strategies for state space search in AI, Depth First and Breadth First Search Heuristic Search, Best First Search and Hill Climbing.

Unit-II

Ant Colony Optimization (ACO) - Theoretical Considerations, Combinatorial optimization and meta heuristic, Stigmergy, Convergence Proofs, ACO Algorithm, ACO and Model Based Search, Variations Of ACO: Elitist Ant System (EAS), Minmax Ant System (MMAS) and Rank Based Ant Colony System (RANKAS), ACO Algorithm for Travelling Sales Person problem, ACO algorithm for feature selection.

Unit-III

Particle Swarm Optimization: Principles of Bird Flocking and Fish Schooling, Evolution of PSO, Operating Principles, PSO Algorithm, Neighbourhood Topologies, Convergence Criteria, Variations of PSO.

Unit-IV

Artificial Bee Colony (ABC) Optimization - Behaviour of real bees, ABC Algorithm, Variations of ABC: Abcgbest and Abcgbestdist, Case Study: Application of ABC algorithm in solving Travelling Salesman Problem, Knapsack Problem and for feature selection.

Suggested Readings:

1. Swarm Intelligence and Bio-Inspired Computation, Theory and Applications by Xin-She Yang, Zhihua Cui, Renbin Xiao, Amir Hossein Gandomi, Mehmet Karamanoglu, Elsevier, 2013.
2. Ant Colony Optimization by Marco Dorigo and Thomas Stutzle, MIT Press, Cambridge, England, 2004.
3. Artificial Intelligence Illuminated by Ben Coppin, Jones and Bartlett Publishers, 2004.
4. Swarm Intelligence Kennedy J and Russel C Eberhart, Morgan Kaufmann Publishers, USA, 2001.
5. A comparative study of Artificial Bee Colony Algorithm by Dervis Karaboga, Bahriye Akay, Applied Mathematics and Computation 214, Elsevier Publications, 2009.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Metaheuristics	https://youtu.be/FKBgCpJlX48?si=OMmSQqdMf2FKQdOD
	Krill Herd Algorithms	https://youtu.be/kdgDVCFBSj8?si=-UFaq80GPaMFWFWy
Unit-II	Ant Colony Optimization	https://youtu.be/xpyKmjJuqhk?si=pVliC2ZU_1YRHxXs
	ACO Algorithm for Travelling Sales Person problem	https://youtu.be/jNd7QJQH-kk?si=61nQmlGUdKMRTqpY
Unit-III	Particle Swarm Optimization	https://youtu.be/uwXFnzWaCY0?si=YHROI-wFBU919b6W
Unit-IV	Artificial Bee Colony Optimization	https://youtu.be/U9ah51wjvgo?si=iU_Aq0YCTZXJiZvA

<table>
<tr><td>Course code</td><td colspan="5">CSE-308A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Digital Image Processing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of digital image processing concepts, image representation, and transformation techniques.
To develop understanding of image enhancement, restoration, segmentation, and feature extraction methods.
To enable application of image processing techniques for image analysis and interpretation.
To develop analytical abilities for evaluating image processing algorithms and outcomes.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define digital image processing concepts, image models, transformations, enhancement techniques, and feature extraction methods.	Level 1: Remember
CO2	Explain operation of image transformation, enhancement, restoration, compression, segmentation, representation techniques and analysis procedures.	Level 2: Understand
CO3	Apply image processing techniques for image enhancement, segmentation, feature extraction, and analysis.	Level 3 : Apply
CO4	Analyze image processing algorithms, segmentation results, feature representations, and image interpretation outcomes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

Unit-II

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms. **Image Restoration:** Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering.

Unit-III

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-IV

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested Readings:

1. Digital Image Processing by Rafael C. Gonzalez, Richard E. Woods, Pearson, 3rd Edition, 2010.
2. Fundamentals of Digital Image Processing by Anil K. Jain, Pearson, 2002.
3. Digital Image Processing by Kenneth R. Castleman, Pearson, 2006.
4. Multidimensional Digital Signal Processing by D, E. Dudgeon and RM. Mersereau, Prentice Hall Professional Technical Reference, 1990.
5. Digital Image Processing by William K. Pratt, John Wiley, New York, 2002.

Useful Video Links:

Unit	Topic	NPTEL Video Lecture Link
Unit-I	Introduction to Digital Image Processing	https://digimat.in/nptel/courses/video/117105135/L01.html
	Image Digitalization, Sampling & Quantization	https://digimat.in/nptel/courses/video/117105135/L03.html
	Color Fundamentals & Image Representation	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
Unit-II	Histogram Processing	https://digimat.in/nptel/courses/video/117105135/L34.html
	Histogram Equalization & Specification	https://digimat.in/nptel/courses/video/117105135/L35.html
	Fourier Transform – I	https://www.youtube.com/watch?v=11b5NnpEoVE
	Image Transformations & Frequency Domain	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_7/7_intro.html
Unit-III	Image Compression Fundamentals	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_7/7_intro.html
	JPEG Compression	https://onlinecourses-archive.nptel.ac.in/noc18_ee40/preview
	Coding Redundancy & Huffman Coding	https://digimat.in/nptel/courses/video/117105135/117105135.html
Unit-IV	Edge Detection & Boundary Detection	https://digimat.in/nptel/courses/video/117105135/117105135.html
	Thresholding & Segmentation	https://arxiv.org/abs/1909.05084
	Hough Transform & Region Based Segmentation	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
	Boundary Representation & Descriptors	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_1/1_intro.html

Annexure AC / 5.11

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations For

Bachelor of Technology Computer Science and Engineering- Data Science

(B.Tech CSE-DS)

3rd Year (A-Scheme)

Effective from the Academic Session 2026-27

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	2 Practical (P) per week	1 Credit
4	2 Seminar/Industrial Training per week	1 Credit

2. RANGE OF CREDIT

A range of credits from 160 to 180 is required for the award of an Undergraduate Degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	73*
2	Professional Elective Courses (Relevant to chosen specialization/branch)	12*
3	Engineering Science Courses	26*
4	Basic Science Courses	21*
5	Humanities and Social Sciences including Management courses	12*
6	Multidisciplinary Open Electives Courses	9*
7	Project work, seminar and internship in industry or appropriate work place/academic and research institutions in India/abroad	16*
8	Value Added Courses	01*
9	Mandatory Courses	Non Credit
	Total Credits	170*

***Minor variation is allowed as per need of the respective disciplines*

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses	PEC
3	Engineering Science Courses	ESC
4	Basic Science Courses	BSC
5	Humanities and Social Sciences including Management courses	HSMC
6	Multidisciplinary Open Electives Courses	MOEC
7	Value Added Courses	VAC
8	Project	PR
9	Mandatory Courses	MC
10	Lab Courses	LC
11	Practical Training	PT
12	Internship	INT

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Computer Science and Engineering-Data Science (B.Tech CSE-DS) – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	DS-301A	Data Preparation and Feature Engineering	3	0	0	3	3	40	60		100	3
2	Professional Core Courses	AI-301A	Machine Learning	3	1	0	4	4	40	60		100	3
3	Professional Core Courses	DS-303A	Predictive Analytics	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	CSE-305A	Design and Analysis of Algorithms	3	0	0	3	3	40	60		100	3
5	Engineering Science Courses	DS-305A	Applied Computational Statistics	3	0	0	3	3	40	60		100	3
6	Professional Elective Courses	Refer Table-II	Professional Elective-II	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	DS-L301A	Data Preparation and Feature Engineering Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	AI-L301A	Machine Learning Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	CSE-L305A	Design and Analysis of Algorithms Lab using C++	0	0	2	2	1	25		25	50	3
10	Engineering Science Courses	DS-L305A	Applied Computational Statistics Lab	0	0	2	2	1	25		25	50	3
11	Practical Training	PT-301A	Practical Training-I	0	0	2	2	1	50			50	3
Total Credits								**24**				**850**	

Note:

I. Students must choose one course from the Professional Elective–II category (Table II). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

II. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.. Students required getting passing marks otherwise, He / She will be required to repeat practical training-I.

Table II: Professional Elective - II

Sr. No.	Course Code	Course Title
1	CSE-301A	Computer Networks
2	CSE-315A	Data Warehouse and Mining
3	DS-307A	Business Intelligence & Analytics
4	DS-309A	NoSQL Databases
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)*

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Computer Science and Engineering-Data Science (B.Tech CSE-DS) – 6th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	DS-302A	Data Visualization	3	0	0	3	3	40	60		100	3
2	Professional Core Courses	AI-001A	Neural Networks	3	1	0	4	4	40	60		100	3
3	Professional Core Courses	CSE-002A	Big Data Analytics	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	DS-304A	Social Network Analysis	3	0	0	3	3	40	60		100	3
5	Professional Elective Courses	Refer Table-III	Professional Elective-III	3	0	0	3	3	40	60		100	3
6	Multidisciplinary Open Elective Courses	Refer Table-IV	Multidisciplinary Open Elective-I	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	DS-L302A	Data Visualization Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	AI-L001A	Neural Networks Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	CSE-L002A	Big Data Analytics Lab	0	0	2	2	1	25		25	50	3
10	Mandatory Courses (Non-Credit)	MC-301A	Constitution of India	2	0	0	2	-	40	60			3
Total Credits								**22**				**750**	

Note:

I. MC-301A is a mandatory non –credit course in which the students will be required passing marks in theory. However these marks will not be added in the total marks.

II. Students must choose one course from the Professional Elective–III category (Table III) and one course from the Open Elective–I category (Table IV). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

III. At the end of 6th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

IV. **For Working Professionals:** Students shall submit a Training/Project Report based on their work in their respective company/organization for the period of the summer/industrial training. The evaluation shall be carried out in the 7th Semester.

Table III: Professional Elective - III

Sr. No.	Course Code	Course Title
1	CSE-303A	Formal Languages and Automata
2	AI-302A	Recommender Systems
3	AI-306A	Explainable AI
4	CSE-308A	Digital Image Processing
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)*

Table IV: Multidisciplinary Open Elective-I

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

<table>
<tr><td>Course code</td><td colspan="5">DS-301A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Data Preparation and Feature Engineering</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To introduce the role of data preparation in the data science lifecycle.
To develop practical skills for cleaning, transforming, and preprocessing data using Python libraries.
To enable students to handle real-world data quality issues programmatically.
To enable students to design reproducible data preprocessing workflows using standard tools.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the concepts, techniques, and workflows of data preparation, cleaning, transformation, feature engineering, and integration in data science.	Level 1: Remember
CO2	Explain methods for handling data quality issues, missing values, outliers, and preparing datasets for analysis and modeling.	Level 2: Understand
CO3	Apply data preprocessing, feature engineering, encoding, scaling, and integration techniques to prepare datasets for machine learning.	Level 3 : Apply
CO4	Analyze data preprocessing strategies, evaluate workflow effectiveness, and ensure readiness of datasets for modeling and deployment.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Data Preparation: Role of data preparation in data science; Types of data and data sources; Data quality dimensions and common issues; Data preprocessing workflow; Introduction to Python data science environment; Overview of NumPy and Pandas; Loading, inspecting, and summarizing datasets; Introduction to feature engineering and its importance in machine learning workflows.

Unit-II

Data Cleaning and Missing Data Handling: Data cleaning process; Detection of missing values; Missing data treatment methods; Handling noisy data and outliers; Duplicate and inconsistent data handling; Data validation and integrity checks using standard techniques.

Unit-III

Data Transformation and Feature Engineering: Data transformation concepts; Normalization and standardization; Scaling techniques – Min-Max, Z-score, Robust scaling; Encoding categorical variables – label encoding and one-hot encoding; Discretization and binning; Feature construction and extraction; Logarithmic and power transformations; Introduction to feature selection methods; Creation of interaction features; Date-time feature extraction; Text-based feature generation; Feature importance and evaluation techniques.

Unit-IV

Data Integration, Feature Selection and Model Readiness: Data integration techniques; Dataset merging and joining; Data aggregation and grouping; Handling data from multiple sources; Dimensionality reduction concepts; Sampling techniques; Data reduction strategies; Advanced feature selection techniques (filter, wrapper, and embedded methods); Preparing datasets for machine learning models; Train-test split; Cross-validation readiness; Reproducible preprocessing and feature engineering workflows.

Suggested Readings:

1. Python for Data Analysis by Wes McKinney, 2nd Edition, O'Reilly Media, 2018.
2. Python Data Science Handbook by Jake VanderPlas, O'Reilly Media, 2016.
3. Python Data Science Handbook: Essential Tools for Working with Data by Jake VanderPlas, 1st Edition, O'Reilly Media, 2016.
4. Data Wrangling with Python by Jacqueline Kazil, Katharine Jarmul, 2016, O'Reilly Media.4.
5. Data Science from Scratch: First Principles with Python by Joel Grus, 2nd Edition, O'Reilly Media, 2019.
6. Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists by Alice Zheng, Amanda Casari, 2018, O'Reilly Media.
7. Feature Engineering and Selection: A Practical Approach for Predictive Models by Max Kuhn and Kjell Johnson, CRC Press, 2019.
8. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron, 3rd Edition, O'Reilly Media.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Role of data preparation in data science	https://onlinecourses.nptel.ac.in/noc22_cs32/preview
	Introduction to Python data science environment	https://www.youtube.com/watch?v=tA42nHmmEKw
	Introduction to Numpy library	https://www.youtube.com/watch?v=O0IrNk1qoUE&list=PLZ2ps__7DhBb2cXAu5PevO_mzgS3Fj3Fs&index=90
	Why Pandas	https://www.youtube.com/watch?v=HCxhHo8tV4U&list=PLZ2ps__7DhBb2cXAu5PevO_mzgS3Fj3Fs&index=91
	Introduction to Feature Engineering	https://youtu.be/BdL-cKUG4hE?si=gWMjusEkq6BKgdvE
Unit-II	Data Cleaning with Python	https://www.youtube.com/watch?v=ZX8vmcSTCrc
	Handling noisy data and outliers	https://www.youtube.com/watch?v=s8wUe49kKMU
Unit-III	Feature Engineering	https://www.youtube.com/watch?v=BdL-cKUG4hE
	Min-Max & Z-score Techniques	https://www.youtube.com/watch?v=lggqjmQzsGI
	Feature Selection Techniques	https://youtu.be/MtapFEwiiug?si=eOWLVb31_BaqCHnI
Unit-IV	Basics of Data Integrations	https://www.youtube.com/watch?v=3_12AZ0CEeo
	Nonlinear Dimensionality Reduction Techniques -I	https://www.youtube.com/watch?v=841lv79yUUQ
	Train, Test, & Validation Sets	https://www.youtube.com/watch?v=ZblqTCFnH-M
	Feature Engineering Pipeline using Scikit-Learn	https://youtu.be/C700yzE_X4Q?si=mhSMd3mzi4Y5BVhh

<table>
<tr><td>Course Code</td><td colspan="5">AI-301A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Machine Learning</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of machine learning concepts, techniques, and applications.
To develop understanding of data preprocessing, feature engineering, and dimensionality reduction methods.
To enable application of machine learning algorithms for prediction and pattern discovery.
To develop analytical skills for evaluating and improving machine learning models.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define machine learning concepts, learning paradigms, techniques, and applications.	Level 1: Remember
CO2	Explain data preprocessing, feature representation, dimensionality reduction, and learning methodologies.	Level 2: Understand
CO3	Apply machine learning algorithms to solve classification, prediction, and clustering problems.	Level 3: Apply
CO4	Analyze machine learning models using appropriate performance measures and evaluation techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Machine Learning: Definition, History, Need, Features, Block diagrammatic representation of learning machines, Classification of Machine Learning: Supervised learning, Unsupervised learning, Reinforcement Learning, Machine Learning life cycle, Applications of Machine Learning.

Unit-II

Dimensionality reduction: Definition, Row vector and Column vector, how to represent a dataset, how to represent a dataset as a Matrix, Data preprocessing in Machine Learning: Feature Normalization, Mean of a data matrix, Column Standardization, Co-variance of a Data Matrix, Principal Component Analysis for Dimensionality reduction

Unit-III

Supervised Learning: Definition, how it works, Types of Supervised learning algorithms k - Nearest Neighbours, Naïve Bayes, Decision Trees, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines, Generalized Linear Models, Nonlinearity and Kernel Methods

Unit-IV

Unsupervised Learning: Clustering: K-means. Ensemble Methods: Boosting, Bagging, Random Forests.
Evaluation: Performance measurement of models in terms of accuracy, confusion matrix, precision & recall, F1-score, receiver Operating Characteristic Curve (ROC) curve and AUC, Median absolute deviation (MAD), Distribution of errors

Suggested Readings:

1. Introduction to machine learning by E. Alpaydin.
2. The Elements of Statistical Learning Data Mining, Inference, and Prediction by T Hastie, R Tibshirani and J Friedman, 2nd Edition, Springer, 2009.
3. Pattern Recognition and Machine Learning by C. M. Bishop, Springer, 2010.
4. Pattern Classification by R. O. Duda, P. E. Hart, and D.G. Stork, John Wiley and Sons, 2012.
5. Networks and Learning Machines by Simon O. Haykin, Neural, Pearson Education, 2016.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Machine Learning	https://youtu.be/fC7V8QsPBec?si=EIpHubT-jNunHaMI
	Supervised Learning	https://youtu.be/OTAR0kT1swg?si=RfDSfvDNG8eWYbMS
	Unsupervised Learning	https://youtu.be/HTSCbxSxs-g?si=_ZIAGWXSR_0GADAU
	Reinforcement Learning	https://youtu.be/9vMpHk44XXo?si=mDfGQrhR3JnBraBD
Unit-II	Dimensionality Reduction: Principal Component Analysis (PCA) & kernel PCA	https://www.youtube.com/watch?v=YepECGlOl4Y=
	Introduction to Data Preprocessing	https://www.youtube.com/watch?v=cO6lrQuepcs
Unit-III	Types of supervised learning	https://www.youtube.com/watch?v=5NSKURYzU70
	Linear Regression	https://youtu.be/_M7Km1XZERU?si=NoLgPErLdkv6frY4
	Logistic Regression	https://youtu.be/g__LURKuIj4?si=JtwGguSfsh_KnguR
Unit-IV	Unsupervised Learning & K-means	https://www.youtube.com/watch?v=FeVrAK77mV8
	The ROC Curve	https://www.youtube.com/watch?v=6RjcFVm_k4c

Course Code	**DS-303A**				
Category	Professional Core Courses				
Course Title	**Predictive Analytics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To provide knowledge of predictive analytics concepts, statistical models, and analytical frameworks. ● To develop understanding of regression, classification, decision trees, and machine learning techniques. ● To enable application of predictive modeling and data preprocessing methods for real-world analytics problems. ● To develop analytical abilities for model evaluation, variable selection, dimensionality reduction, and performance optimization.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define predictive analytics concepts, analytical frameworks, regression models, classification techniques, and machine learning fundamentals.	Level 1: Remember
CO2	Explain predictive modeling methods, data preprocessing techniques, feature selection approaches, and analytical processes.	Level 2: Understand
CO3	Apply predictive analytics techniques, statistical models, and machine learning methods to solve real-world problems.	Level 3: Apply
CO4	Analyze predictive models using evaluation measures, dimensionality reduction methods, regularization techniques, and validation strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Introduction: The Analytics Life Cycle, Introduction to Predictive Analytics, Matrix Notation, Basic Foundations, Model, Method and Feature Selection, CRISP-DM framework, and data partitioning (training/validation sets).
Regression: Covariance, Correlation and ANOVA review; Simple Linear Regression, OLS Model Diagnostics, Dummy Variables, Multivariate Regression, OLS Assumptions, Weighted Least Squares (WLS), Generalized Linear Models (GLM).

Unit II

Classification Models: Introduction, Binomial Logistic Regression, Multinomial Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis.
Decision Trees: Introduction Regression Trees, Regression Tree Issues, Classification Trees, Pruning Trees, Bootstrap Aggregation (Bagging), Random Forest Models, Support Vector Machines (SVM), and Neural Networks.

Unit-III

Data Pre-Processing: Overview, Variable Types, Introduction to Data Transformations.
Data Transformations: Categorical to Dummy Variables, Polynomials, Box-Cox Transformation, Log & Elasticity Models, Logit Transformation, Count Data Models, Centering, Standardization, Rank Transformations, Lagging Data (Causal Models), Data Reduction.

Unit-IV

Variable Selection: Dimensionality Issues, Multi-Collinearity, Variable Selection Methods, Step Methods.
Dimensionality: Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO, Dimension Reduction Models, Principal Components Regression (PCR), Partial Least Squares (PLS).
Machine Learning: Machine Learning Overview, Bias vs. Variance Trade-off, Error Measures, Cross-Validation.

Suggested Readings:

1. An Introduction to Statistical Learning: with Applications in R by James, Witten, Hastie and Tibshirani, Springer, 1st Ed., 2013.
2. The Elements of Statistical Learning-Data Mining, Inference, and Prediction by Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2nd Ed., Springer Verlag, 2009.
3. Predictive & Advanced Analytics (IBM ICE Publication).

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Predictive Analytics	https://youtu.be/suIMSpBJiyM?si=wghj_qWKuUc01sS0
	Method and Feature Selection	https://youtu.be/0xFT0yvqRo4?si=BC3RJuyDRl8b8kdQ
	CRISP-DM framework, data partitioning	https://youtu.be/q_okDS2RtzY?si=L0-fXwDtLUchigXM
Unit-II	Multinomial Logistic Regression	https://youtu.be/cM4lmkq8XsU?si=Z0F0fT0CgHIBJWK7
	Linear Discriminant Analysis	https://youtu.be/LNL4G87DpI0?si=jthNR0t1c4syCrkM
	Introduction Regression Trees	https://youtu.be/1GZDVRskXGE?si=Mlc1rNSDs_5c2zFB
	Support Vector Machines (SVM)	https://youtu.be/3ki3RKdbcPo?si=Og-G9XnbOPUw1WBf
Unit- III	Data pre-processing	https://youtu.be/L_DeunKU-FA?si=EYEVxpjcKJlqeJSj
	Categorical to Dummy Variables	https://youtu.be/aMPeChbJg9A?si=7A0vzl-UDnTH3V92
	Standardization, Rank Transformations	https://youtu.be/J_rDIm7dI3Y?si=y778gzeyW5gfaiRV
	Lagging Data (Causal Models)	https://youtu.be/LpRC9ds6GIc?si=MXYyawUQo_WGsJiT
Unit- IV	Variable Selection Methods, Step Methods.	https://youtu.be/9h1YikP2Sno?si=hr5O_7TK9lbpLAzy
	Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO	https://youtu.be/whA8Geg4Knk?si=6Ps80ti6EE4RYbPj
	Principal Components Regression (PCR)	https://youtu.be/SWfucxnOF8c?si=4zx8fArev1W5EZZc

Course Code	**CSE-305A**				
Category	Professional Core Courses				
Course Title	**Design and Analysis of Algorithms**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of algorithm design techniques and complexity analysis. • To develop understanding of algorithmic paradigms and optimization methods. • To enable application of algorithms for solving computational problems. • To develop analytical skills for evaluating algorithm efficiency and complexity.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define algorithm design concepts, complexity measures, design paradigms, and computational problem classes.	Level 1: Remember
CO2	Explain algorithmic strategies, optimization techniques, and complexity concepts used in problem solving.	Level 2: Understand
CO3	Apply appropriate algorithm design techniques to solve computational and optimization problems.	Level 3: Apply
CO4	Analyze algorithms and computational problems based on correctness, efficiency, and complexity.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Algorithms: Algorithm, Performance Analysis (Time and Space complexity), Asymptotic Notation (Big OH, Omega and Theta)-best, average and worst-case behaviour.
Divide and Conquer: General method, Binary Search, Merge Sort, Quick Sort, and other sorting algorithms with divide and conquer strategy, Strassen's Matrix Multiplication algorithms.

Unit-II

Greedy Method: General method, Fractional Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Single source shortest paths.
Dynamic Programming: General method, Optimal Binary Search Trees, 0/1 knapsack, The Travelling Salesperson problem.

Unit-III

Back Tracking: General method, The 8-Queen's problem, Sum of subsets, Graph Colouring, Hamiltonian Cycles. Branch and Bound: The method, 0/1 knapsack problem, Travelling Salesperson problem, Efficiency considerations.

Unit-IV

NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph problems, NP hard scheduling problems, NP hard code generation problems, and Some simplified NP hard problems.

Suggested Readings:

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publication.
2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald Lrivest: 1990, TMH.
3. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E ., 1974, Addison Wesley.
4. Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetnieni, 1997, MGH.

Useful Video links:

Unit No.	Topic	Link
Unit-I	Asymptotic Notation	https://youtu.be/EL9T1ngiCqA?si=oaMBKNhfiIOODUlM
	Divide and Conquer Paradigm	https://youtu.be/xdD0nIWe0wA?si=P3DQs80dHBg3-aiM
Unit-II	Minimum Cost Spanning Tree	https://youtu.be/k9jemw3SZe0?si=93sq4N5-AjF-oVhy
	Knapsack Problem	https://youtu.be/-Cg-aL1D8CM?si=MSMQTKSaPqcNuZME
Unit-III	Sum of subsets	https://youtu.be/yDjadhjQ3eE?si=-6NQH4xIHYqemNp6
	Traveling Salesman Problem	https://youtu.be/-cLsEHP0qt0?si=-asPYE1zbCTMokLK
Unit-IV	Cook's theorem	https://youtu.be/qpCvPS-WwGA?si=CswYDncPrmCi3b_W
	NP Complete Problems	https://youtu.be/id7k6gUkZ8Y?si=fCSY5t-XMgUKzPi1

Course Code	**DS-305A**				
Category	Engineering Science Courses				
Course Title	**Applied Computational Statistics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are To provide knowledge of statistical analysis, probability theory, estimation, and hypothesis testing. To develop understanding of inferential statistics and multivariate analytical techniques. To enable application of statistical methods for data analysis and decision making. To develop analytical abilities for evaluating stochastic processes and computational statistical models.				
Course Pre-requisite	Mathematics upto12th Standard and Engineering Mathematics-I & II				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define statistical concepts, probability distributions, estimation methods, hypothesis testing procedures, and stochastic processes.	Level 1: Remember
CO2	Explain inferential statistical techniques, multivariate analysis methods, classification approaches, and stochastic models.	Level 2: Understand
CO3	Apply statistical methods, multivariate techniques, and computational procedures to analyze datasets and solve data science problems.	Level 3: Apply
CO4	Analyze statistical models, multivariate relationships, stochastic processes, and data patterns for decision making.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Types of Data (Quantitative, Qualitative, Logical), Exploratory Data Analysis (Histogram, Scatter plots, Box plot, Fundamentals of Descriptive Statistics (moments- Measures of Central Tendency, Measure of spread, Measure Shape), Overview of Probability and Combinatorics, Inferential Statistics (Normal Distribution, Statistic Sampling, Central Limit Theorem), Estimations (Point and Intervals- Confidence intervals with means, sample proportions), Hypothesis Testing :Introduction, Confidence Intervals, Critical Value based approach, P-value base approach, Z Tests, T Tests ,the $\chi 2$ distribution, ANOVA/ANCOV.

Unit-II

Multivariate Analysis: Multivariate distributions: multivariate normal distribution and its properties, distributions of linear and quadratic forms, tests for partial and multiple correlation coefficients and regression coefficients and their associated confidence regions. Data analytic illustrations. Wishart distribution (definition, properties),

construction of tests, union-intersection and likelihood ratio principles, inference on mean vector, Hotelling's T2. MANOVA- Inference on covariance matrices.

Unit-III

Classification methods: Discriminant analysis, principal component analysis and factor analysis, Canonical Correlation analysis, Correspondence Analysis, Multidimensional Scaling, Cluster analysis. Nonparametric and robust methods of multivariate analysis. Graphical representation of multivariate data.

Unit-IV

Stochastic Process: Markov chains with stationary transition probabilities, properties of transition functions, classification of states, Stationary distribution of a Markov chain, existence and uniqueness, convergence to the stationary distribution. Methods based on Markov chains for simulation of random vectors. MCMC algorithm. Random Walks, queueing processes, branching processes. Gambler's ruin problem, transient states.

Suggested Readings:

1. An Introduction to Probability Theory and its Applications by W. Feller Vol.-II.
2. A First Course in Stochastic Processes by S. Karlin and H. M. Taylor.
3. Introduction to Stochastic Processes by P. G. Hoel, S. C. Port and C. J. Stone.
4. Introduction to Probability Models by S. Ro.
5. An Introduction to Multivariate Statistical Analysis by T. W. Anderson.
6. Introduction to Probability by Ross, 9th edition, Pearson, 2006.
7. Introduction to Probability and Statistics Using R by G. Jay Kerns, 2016.
8. An Adventure in Statistics by Andy Field SAGE Publications, 2016.
9. Head First Statistics by Dawn Griffiths, O'Reilly media Inc., 2019.
10. A step by Step Guide to Exploratory Factor Analysis with R and R Studio, by Marley W. Watkins, Tylor & Francis Group, 2021.

Useful Video links:

Unit No.	Topic	Link
Unit-I	Types of Data (Quantitative, Qualitative, Logical)	https://youtu.be/ALs6JW1wgE4?si=DY_cM3YYoTd5nl3e
	Exploratory Data Analysis	https://youtu.be/QiqZliDXCCg?si=yuZeyUOarteAHGkS
	Fundamentals of Descriptive Statistics	https://youtu.be/r-V1uZx-ndM?si=L8qSNEDAew1EnOzz
	Overview of Probability and Combinatorics	https://youtu.be/Z1zdkcwosD4?si=uRmTYfLcPMTclQvp
	Hypothesis Testing	https://youtu.be/_OjC0HZHTK4?si=9kJ5JaUcGtd0penY
Unit-II	Multivariate distributions	https://youtu.be/c6bK25xY22w?si=97wxEwL5YzrPkWhR
	Tests for partial and multiple correlation coefficients and regression	https://youtu.be/jsm226MM7JE?si=ZfPJcw6w-tjmJNGE
	Wishart distribution	https://youtu.be/RvNJOABAKqU?si=oXiSI1AAp195w0it
	MANOVA- Inference on covariance matrices	https://youtu.be/Rf94MACqfxs?si=_aA4CVPWr2YzapnU
Unit-III	Discriminant analysis	https://youtu.be/vnHkTnRFdAU?si=lmNf9iI77D-tL15X
	Multidimensional Scaling	https://youtu.be/NPcwjc6Oh7k?si=A8jziP3rfxmPrEmD
	Nonparametric and robust methods of multivariate analysis	https://youtu.be/-3iGSoubUjc?si=hdGVXA0WyVMlXK20
Unit-IV	Nonparametric and robust methods of multivariate analysis	https://youtu.be/-3iGSoubUjc?si=QA0lRYWBsz2_lVjl
	MCMC algorithm	https://youtu.be/yApmR-c_hKU?si=lvCZJq2CImWtPToK
	Gambler's ruin problem, transient states	https://youtu.be/Ne2lmAZI4-I?si=UWRMN-oTOPcH7nJC

<table>
<tr><td>Course Code</td><td colspan="5">DS-L301A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Data Preparation and Feature Engineering Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To enable students to implement Python programs for loading and summarizing datasets using NumPy and Pandas.
● To guide students in performing data cleaning by handling missing values, duplicates, inconsistencies, and outliers.
● To provide hands-on practice in applying data transformation techniques such as scaling, encoding, and feature engineering.
● To train students to prepare integrated and model-ready datasets using sampling and validation strategies.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Implement dataset loading, inspection, and summarization using NumPy & Pandas.	Level 2: Understand
CO2	Perform data cleaning, missing value handling, and data validation.	Level 3: Apply
CO3	Apply data transformation and feature engineering techniques for preprocessing.	Level 3: Apply
CO4	Analyze and organize datasets to create model-ready data using appropriate sampling, reduction, and splitting strategies.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**	**COs**
1.	Install and explore Python data science environment (NumPy, Pandas, Matplotlib).	CO1
2.	Load datasets and perform inspection and statistical summary.	CO1
3.	Detect and handle missing values using different techniques.	CO2
4.	Identify and treat noisy data and outliers.	CO2
5.	Remove duplicate and inconsistent records.	CO2
6.	Perform normalization and standardization (Min-Max, Z-Score, Robust scaling).	CO3
7.	Encode categorical variables using Label Encoding and One-Hot Encoding.	CO3
8.	Perform discretization and binning of continuous data.	CO3
9.	Construct new features and perform feature extraction.	CO3

10.	Apply feature selection methods (filter-based techniques).	CO4
11.	Merge and join datasets from multiple sources.	CO4
12.	Perform data aggregation and grouping operations.	CO4
13.	Apply sampling techniques and dimensionality reduction.	CO4
14.	Prepare dataset for machine learning (train-test split and cross-validation readiness).	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Load Dataset & Summary	https://colab.research.google.com/drive/1M8xTPtJVcY5UZTZusL6jiqooRBamkYen?usp=sharing
Missing Value Handling	https://colab.research.google.com/drive/1M8xTPtJVcY5UZTZusL6jiqooRBamkYen?usp=sharing
Encode categorical variables	https://colab.research.google.com/drive/1M8xTPtJVcY5UZTZusL6jiqooRBamkYen?usp=sharing

Course Code	**AI-L301A**				
Category	Professional Core Courses				
Course Title	**Machine Learning Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: • To understand and implement basic machine learning algorithms for classification and prediction tasks. • To apply clustering and recommendation techniques for pattern discovery and personalized suggestions. • To perform dimensionality reduction and optimization using PCA and Gradient Descent techniques. • To develop and evaluate advanced machine learning models using Artificial Neural Networks (ANN).				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand the fundamental concepts of machine learning, including types of learning, basic algorithms, and model building techniques.	Level 2: Understand
CO2	Apply machine learning algorithms to implement solutions for classification, regression, and clustering problems using appropriate techniques.	Level 3: Apply
CO3	Apply data preprocessing, feature selection, and dimensionality reduction techniques for effective data analysis and model improvement.	Level 3: Apply
CO4	Analyze the performance of machine learning models using evaluation metrics and optimize models for better accuracy and efficiency.	Level 4: Analyze

List of Experiments:

Sr. No.	**Contents**	**COs**
1	Study the basic concepts of Machine Learning.	CO1
2	Write a program to implement Linear Regression for predicting continuous target values based on given input features.	CO2
3	Write a program to implement Logistic Regression for binary classification of a dataset.	CO2
4	Write a program to implement K-Nearest Neighbors (KNN) algorithm for classification problems.	CO2
5	Write a program to implement Decision Tree classifier for predicting outcomes based on input data.	CO3
6	Write a program to implement Random Forest algorithm for classification and regression tasks.	CO4
7	Write a program to implement Support Vector Machine (SVM) for classification of data points.	CO3

8	Write a program to implement Naive Bayes classifier for text or categorical data classification.	CO3
9	Write a program to implement K-Means clustering algorithm for grouping similar data points.	CO3
10	Write a program to implement Principal Component Analysis (PCA) for dimensionality reduction.	CO3
11	Write a program to implement Gradient Descent algorithm for optimizing a machine learning model.	CO4
12	Write a program to implement Artificial Neural Network (ANN) for classification or prediction tasks.	CO4
13	Write a program to implement a Recommender System using collaborative filtering technique.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Useful Video Links:

Experiment Name	**Virtual Lab Link**
Implement Random Forest for Multi-Class Classification	https://www.youtube.com/watch?v=5ONlGP0Nx3Q
Gradient Descent	https://www.youtube.com/watch?v=JA5rIxOve20
Principal Component Analysis (PCA)	https://www.youtube.com/watch?v=hkCT-6KJAK0
K-Means Clustering	https://www.youtube.com/watch?v=oFr4JX75MCc

Course Code	**CSE-L305A**				
Category	Professional Core Courses				
Course Title	**Design and Analysis of Algorithms Lab Using C++**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop understanding of algorithm design techniques and complexity analysis. • To provide practical exposure to sorting and graph algorithms. • To develop skills in greedy, dynamic programming, and backtracking techniques. • To develop analytical skills for evaluating algorithm performance.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain algorithm design techniques and complexity concepts.	Level 2: Understand
CO2	Apply divide-and-conquer and graph algorithms to computational problems.	Level 3: Apply
CO3	Apply greedy, dynamic programming, and backtracking techniques to optimization problems.	Level 3: Apply
CO4	Compare the performance of selected algorithms for computational problems.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Study the basic concepts of algorithm design and analysis of algorithms.	CO1
2	Write a C++ Program to perform Quick Sort using Divide & Conquer Technique.	CO2
3	Write a C++ program to perform Merge Sort using Divide and Conquer technique and compare its performance with Quick Sort for different input sizes.	CO2 CO4
4	Write a C++ program to find all-pairs shortest paths using the Floyd–Warshall algorithm and compare its performance with Dijkstra's algorithm for suitable graphs.	CO2 CO4
5	Write a C++ Program to solve the Knapsack Problem using Greedy Approach.	CO3
6	Write a C++ Program for Shortest Path using Dijkstra's Algorithm.	CO2
7	Write a C++ Program to find Minimum Spanning Tree using Prim's Algorithm.	CO2
8	Write a C++ Program for Sum of Subsets Problem using Back Tracking.	CO3

9	Write a C++ Program to solve Travelling Sales Problem using the Dynamic Programming Approach.	CO3
10	Write a C++ program to solve the N-Queen Problem using Backtracking and analyze the effect of increasing board size on execution time.	CO3 CO4
11	Write a Program to Check whether a given graph is connected or not using DFS method.	CO2

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Write a C++ Program to perform Quick Sort using Divide & Conquer Technique.	https://ds1-iiith.vlabs.ac.in/exp/quick-sort/quick-sort/index.html
Write a C++ Program for Shortest Path using Dijkstra's Algorithm.	https://ds2-iiith.vlabs.ac.in/exp/dijkstra-algorithm/index.html
Write a C++ Program to find Minimum Spanning Tree using Prim's Algorithm.	https://ds2-iiith.vlabs.ac.in/exp/min-spanning-trees/index.html

<table>
<tr><td>Course Code</td><td colspan="5">DS-L305A</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Applied Computational Statistics Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To provide practical knowledge of R programming and R Studio environment for statistical data analysis and visualization.
● To develop skills in implementing graphical and statistical techniques using R language.
● To enable students to apply statistical methods and hypothesis testing techniques for data analysis using R programming.
● To develop analytical ability for interpreting multivariate statistical techniques and data-driven results using R.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the concepts of statistical computing, graphical representation, and data analysis techniques using R language and R Studio.	Level 2: Understand
CO2	Apply R programming techniques to implement statistical computations, graphical plots, and probability distributions.	Level 3: Apply
CO3	Apply hypothesis testing and multivariate statistical methods for analyzing datasets using R programming.	Level 3: Apply
CO4	Analyze datasets and interpret statistical and multivariate analysis results using R programming tools and techniques.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Introduction to Study of R language and R Studio.	CO1
2	Write a program to draw HISTOGRAM implementation in R Language.	CO1
3	Write a program to draw BOXPLOT implementation in R Language.	CO2
4	Write a program to draw Scatterplot implementation in R Language.	CO2
5	Write a programme to compute Mean, Median and Standard Deviation.	CO2
6	Write a programme to calculate Skewness.	CO3
7	Write a programme to find Normal Distribution.	CO3
8	Write a programme to Analyze data set using Z test.	CO3

9	Write a programme to Analyze data set using One sample T test.	CO3
10	Write a programme to find Multivariate Normal Distribution.	CO4
11	Write a programme to analyze PCA.	CO4
12	Write a programme to analyze Linear Discreminant Analysis.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Histogram in R	https://colab.research.google.com/drive/12ZIwxGQGEUvl7qc6AT9awAWOqQnL-nzd?usp=sharing
Mean, Median and Standard Deviation	https://colab.research.google.com/drive/12ZIwxGQGEUvl7qc6AT9awAWOqQnL-nzd?usp=sharing
Multivariate Normal Distribution	https://colab.research.google.com/drive/12ZIwxGQGEUvl7qc6AT9awAWOqQnL-nzd?usp=sharing

<table>
<tr><td>Course Code</td><td colspan="5">PT-301A</td></tr>
<tr><td>Category</td><td colspan="5">Practical Training</td></tr>
<tr><td>Course Title</td><td colspan="5">Practical Training-I*</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are to
Develop practical skills using industry-standard software tools and technologies.
Apply software engineering practices and technical documentation in real-world projects.
Enhance professional communication, teamwork, time management, and ethical practices.
Analyze and solve real-world computing problems using appropriate tools and methodologies.</td></tr>
<tr><td>Assessment</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain industry practices, coding standards, and software development processes.	Level 2: Understand
CO2	Apply computing knowledge and programming skills to solve practical problems.	Level 3: Apply
CO3	Demonstrate effective communication, teamwork, professional ethics, and time management.	Level 3: Apply
CO4	Analyze real-world computing problems and formulate appropriate solutions using collaborative and systematic approaches.	Level 4: Analyze
CO5	Evaluate the application of theoretical concepts, modern technologies, and innovative methodologies to solve practical computing challenges.	Level 5: Evaluate
CO6	Utilize industry-standard tools, frameworks, platforms, and development methodologies for the design, implementation, testing, and deployment of software solutions.	Level 6: Create

Note:

1. Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the V semester.
2. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

<table>
<tr><td>Course code</td><td colspan="5">CSE-301A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Computer Networks</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide fundamental knowledge of computer networking concepts, architectures, communication models, and transmission techniques.
To develop understanding of networking protocols, addressing methods, routing mechanisms, and network services across different layers.
To enable students to apply networking principles and protocols for data communication and problem solving in computer networks.
To develop analytical understanding of network performance, congestion control, QoS, Networking technologies, and security mechanisms.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts, models, protocols, devices, services, techniques, and security mechanisms of computer networks.	Level 1: Remember
CO2	Explain the principles, operations, functionalities, and interactions of computer networking components, protocols, architectures, and services.	Level 2: Understand
CO3	Apply networking concepts, protocols, algorithms, addressing methods, and security techniques to solve computer networking problems.	Level 3 : Apply
CO4	Analyze network performance, routing, QoS, congestion control, and security mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Data communication, Components, Computer networks and its historical development, distributed processing, network performance metrics (bandwidth, throughput, delay, jitter and packet loss), Internet Network **Models:** OSI model and TCP/IP Model.
Physical Layer: physical layer functions, Data Representation, Simplex, Half Duplex and Full Duplex Transmission, Modulation and Multiplexing, Packet and circuit switching, Transmission media, Topologies, connectionless and connection-oriented services.
Data Link Layer: Data link layer functions and services, MAC Addressing, Framing, flow control, error detection and correction (parity check, checksum, CRC and Hamming code), Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Unit-II

Medium Access Control: MAC layer functions, Random access, Controlled Access and channelization protocols, CSMA/CD and CSMA/CA.

Network Layer: Network layer functions and services, Logical addressing, IPv4 classful and classless addressing, subnetting, NAT, IPv4, ICMPv4, ARP, RARP and BOOTP, IPv6, IPv6 addressing, DHCP.
Network Devices: Repeater, hub, switch, router and gateway.

Unit-III

Routing Algorithms: Introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State and Distance Vector Routing.
Transport Layer: Transport layer functions and services, Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management.
Application Layer: Application layer functions and services, Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP.

Unit-IV

Congestion Control, Quality of Service, QoS parameters and QoS Improving techniques.
LAN and Wireless Networks: Ethernet, Wireless LAN (IEEE 802.11), Wi-Fi architecture, Token Bus, Token Ring, MAN Architecture- DQDB, WAN Architectures- Frame Relay, ATM, SONET/SDH
Network Security: Firewalls, security goals, types of attack, Introduction to cryptography, Types of ciphers: symmetric and asymmetric key ciphers.

Suggested Readings:

1. Data Communication and Networking by Behrouz A. Forouzan, 4th Edition, McGraw-Hill.
2. Data and Computer Communication by William Stallings, 8th Edition, Pearson Prentice Hall India.
3. Computer Networks by Andrew S. Tanenbaum, 8th Edition, Pearson New International Edition.
4. Internetworking with TCP/IP by Douglas Comer, Volume 1, 6th Edition, Prentice Hall of India.
5. TCP/IP Illustrated by W. Richard Stevens, Volume 1, Addison-Wesley, United States of America.

Useful Video Links

Unit No.	Topics	Links
Unit-I	Introduction to Computer Networks	https://www.youtube.com/watch?v=lnU-Zw3NEEQ
	OSI Model and TCP/IP Model	https://youtu.be/zzXs0EnCin0
	Packet Switching and Circuit Switching	https://youtu.be/29Qdz0FmvmQ?si=Yedvul4uJzmfkDsh
Unit-II	Medium Access Control Protocols	https://youtu.be/sx0UPzztC5o?si=VDg2wx1B68gvenjU
	Network Layer Introduction	https://youtu.be/aP346youQOk?si=6DRTU5dc1t21Dk_D
Unit-III	Routing Algorithms	https://youtu.be/AmlOSGYkKXc?si=87eNMi6RPeTd0FkL
	Transport Layer – TCP and UDP	https://youtu.be/EqzDTO9tdqs?si=16VZZu9Oz3IzOeOA
Unit-IV	Congestion Control and QoS	https://nptel.ac.in/courses/106105081
	SDH/SONET Layering, Frame Structure	https://youtu.be/f5EmFoXlYyQ?si=8ilxCANj5flH7TP4

Course Code	**CSE-315A**				
Category	Professional Elective Courses				
Course Title	**Data Warehouse and Mining**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V(Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the fundamentals of data warehousing and data mining. ● To provide knowledge of data mining techniques for pattern discovery and classification. ● To familiarize students with clustering methods and web data mining concepts. ● To develop understanding of techniques and tools for knowledge discovery from large datasets.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define concepts and terminology related to data warehousing and data mining.	Level 1: Remember
CO2	Explain data mining techniques, algorithms, and knowledge discovery processes.	Level 2: Understand
CO3	Apply data warehousing and data mining methods to extract useful patterns from data.	Level 3: Apply
CO4	Analyze data mining models, clustering techniques, and web mining approaches for knowledge discovery.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Data warehousing: Introduction, Operational data stores, ETL, Data warehouses – design guidelines for data warehouse implementation, Data warehouse metadata; OLAP – introduction, Characteristics, Multidimensional view and data cube, Data cube operations.

Unit-II

Data mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation(FP, growth), performance evaluation of algorithms.

Unit-III

Classification: Introduction, decision tree, tree induction algorithm – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method; classification software, software for association rule mining; case study; KDD Insurance Risk Assessment.

Unit-IV

Cluster analysis: Introduction, partitional methods, hierarchical methods, and density based methods, dealing with large databases, cluster software.
Web Data Mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

Suggested Readings:

1. Data mining concepts and techniques by Han J., Kamber M. and Pei J., Morgan Kaufmann Publishers 3rd Ed, 2011.
2. Data Mining by Pudi V., Krishana P.R., Oxford University press, 1st Ed., 2009.
3. Data mining by Adriaans P., Zantinge D., Pearson education press, 1st Ed., 1996.
4. Data Warehousing Fundamentals by Pooniah, Willeyinterscience Publication, (2001), 1st ed.

Useful Video links

Unit No	Topics	Links
Unit-I	Introduction, Knowledge Discovery Process	https://www.youtubeeducation.com/watch?v=ykZ-_UGcYWg
	OLAP	https://youtu.be/m-aKj5ovDfg?si=1IqwlHoN5T4VWfPK
Unit-II	Classification	https://www.youtubeeducation.com/watch?v=VsYKqOokgaE
	Apriori algorithm	https://youtu.be/hEQkqpmtx-Y?si=hMDJ-3cvDvx_PIur
Unit-III	Bayes Classifier	https://www.youtubeeducation.com/watch?v=DXnnvprUl2Y
	Decision Tree	https://www.youtubeeducation.com/watch?v=4l4_BREP6ZI
Unit-IV	Cluster analysis	https://www.youtubeeducation.com/watch?v=VcPWL9Nlozs
	Density based methods	https://youtu.be/E_SdiZQ23xI?si=hupzFk1EjSNbge4q

Course Code	**DS-307A**				
Category	Professional Elective Courses				
Course Title	**Business Intelligence & Analytics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide knowledge of business intelligence, analytics, data mining, and decision-support systems. • To develop understanding of predictive analytics, text mining, web analytics, and sentiment analysis techniques. • To enable application of analytical tools and models for business problem solving and decision making. • To develop analytical abilities for evaluating business intelligence solutions and emerging analytics technologies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	**Skill Demonstrated**	**RBT Level**
CO1	Define business intelligence concepts, predictive analytics methods, data mining techniques, web analytics, and knowledge management systems.	Level 1: Remember
CO2	Explain business analytics methodologies, predictive models, sentiment analysis, web mining techniques, and decision-support mechanisms.	Level 2: Understand
CO3	Apply analytical models, data mining methods, optimization approaches, and web analytics tools to solve business problems.	Level 3: Apply
CO4	Analyze business intelligence systems, analytics outcomes, decision-support models, big data solutions, and emerging business trends.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Introduction to Business Intelligence, Designing Business Intelligence Application, Requirements Gathering, Establishing the Technical Architecture, Designing a Business Intelligence Solution, Designing Dimensional Models, Designing the Physical Databases.

Predictive Analytics: Data Mining Concepts- Definitions, Characteristics, and Benefits, How Data Mining Works, Data Mining Versus Statistics Data Mining Process, Data Mining Methods, Data Mining and Privacy Issues, Regression, Classification, Association Rules, clustering, Techniques for Predictive Modelling – ANN- SVM.

Unit-II

Text Analytics, Text Mining, And Sentiment Analysis: Text Analytics, Text Mining, and Sentiment Analysis, Natural Language Processing, Text Mining Process, tools, Sentiment Analysis, Overview, Process, Applications, Speech Analytics, Rule based, Multi, Layer, Hybrid Sentimental analysis, Machine Learning in Sentimental analysis.
Web Analytics and Web Mining: Web Mining Overview, Web Content and Web Structure Mining, Search Engines, Search Engine Optimization, Web Analytics Technologies, metrics, Web Analytics Maturity Model and Web Analytics Tools.

Unit-III

Prescriptive Analytics: Decision Support Systems Modeling, Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Decision Modeling with Spreadsheets, Mathematical Programming Optimization, Decision Analysis with Decision Tables and Decision Trees, Problem-Solving Search Methods, Problem-Solving Search Methods.

Unit-IV

Knowledge Management and Big Data Analytics: Knowledge Management –Concepts, Definitions, Approaches, tools and techniques, Big Data and Analytics, Fundamentals of Big Data Analytics, Technologies, Data Scientist, Big Data and Data Warehousing, Automated Decision Systems and Expert Systems, Business Analytics: Emerging Trends and Future Impacts, Recent Trends and contemporary issues.

Suggested Readings:

1. Business Intelligence and Analytics" by Efraim Turban, Ramesh Sharda, Dursun Delen, 10th Edition, Pearson, 2015.
2. Business Analytics: Data Analysis & Decision Making by S.Christian Albright, Wayne L.Winston, 6th Edition, CENGAGE INDIA, 2017.
3. Business Analytics by Dinabandhu Bag, Routledge, 1st edition, 2016.
4. Business Intelligence Guidebook: From Data Integration to Analytics by Rick Sherman, Morgan Kaufmann, 1st edition 2014.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Business Intelligence	https://youtu.be/f1if5sqCS4U?si=2pQRFbSoLCm3gpYG
	Data Mining Concepts	https://youtu.be/ykZ-_UGcYWg?si=vLCaMR8FQ4iIczN9
Unit-II	Sentiment Analysis	https://youtu.be/bbeV9YxAvqs?si=JwJa_DXEoyOIzUd6
	Natural Language Processing	https://youtu.be/G6wdZQw4d8Y?si=dCUZmaN7a6-idFWZ
Unit-III	Problem-Solving Search Methods	https://youtu.be/NCq26BvEYIg?si=nGJKmQb76UK0kO-4
	Reasoning under Uncertainty	https://youtu.be/1lKsSiEsJ18?si=iAqzM6CXfu-L0bjt
Unit-IV	Big Data and Analytics	https://youtu.be/uhj5oKRqY6w?si=y41jLEHZIqKKUnfL
	Knowledge Management	https://youtu.be/ECzT3czfqGU?si=mMau0SswidK3nhZk

Course Code	**DS-309A**				
Category	Professional Elective Courses				
Course Title	**NoSQL Databases**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide knowledge of NoSQL database concepts, architectures, data models, and distributed storage systems. • To develop understanding of key-value, document-oriented, columnar, and graph database technologies. • To enable application of NoSQL databases for scalable data storage, retrieval, and processing. • To develop analytical abilities for evaluating performance, consistency, scalability, and optimization techniques in NoSQL systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define NoSQL database concepts, architectures, data models, distributed storage mechanisms, and scalability principles.	Level 1: Remember
CO2	Explain NoSQL data models, database architectures, consistency mechanisms, storage strategies, and graph analytics techniques.	Level 2: Understand
CO3	Apply NoSQL database operations, querying methods, indexing techniques, and distributed processing approaches for database applications.	Level 3: Apply
CO4	Analyze scalability, consistency, performance, storage architectures, and optimization strategies in NoSQL database systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to NoSQL Concepts: Database revolutions: First generation, second generation, third generation, Managing Trans-actions and Data Integrity, ACID and BASE for reliable database transactions, Speeding performance by strategic use of RAM, SSD, and disk, Achieving horizontal scalability with Database sharding, Brewers CAP theorem.

NoSQL Data Architecture Patterns: NoSQL Data model: Aggregate Models- Document Data Model- Key-Value Data Model- Columnar Data Model, Graph Based Data Model, Graph Data Model, NoSQL system ways to handle big data problems, Moving Queries to data, not data to the query, hash rings to distribute the data on clusters, replication to scale reads, Database distributed queries to Data nodes.

Unit-II

Key Value Data Stores: From array to key value databases, Essential features of key value Databases, Properties of keys, Characteristics of Values, Key-Value Database Data Modeling Terms, Key-Value Architecture and implementation Terms, Designing Structured Values, Limitations of Key-Value Databases, Design Patterns for Key-Value Databases, Case Study: Key-Value Databases for Mobile Application Configuration.
Document Oriented Database: Document, Collection, Naming, CRUD operation, querying, indexing, Replication, Sharding Consistency Implementation: Distributed consistency, Eventual Consistency, Capped Collection, Case studies: document oriented database: Mongo DB and/or Cassandra.

Unit-III

Columnar Data Model – I: Data warehousing schemas: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes, Indexing, Adaptive indexing and Database Cracking.
Columnar Data Model – II: Advanced techniques: Vectorized Processing, Compression, Write penalty, Operating Directly on Compressed Data Late Materialization Joins, Group-by, Aggregation and Arithmetic Operations, Case Studies.

Unit-IV

Data Modeling With Graph: Comparison of Relational and Graph Modeling, Property Graph Model Graph Analytics: Link analysis algorithm- Web as a graph, Page Rank- Markov chain, page rank computation, Topic specific page rank (Page Ranking Computation techniques: iterative processing, Random walk distribution Querying Graphs: Introduction to Cypher, case study: Building a Graph Database Application- community detection. Recent trends in Databases/Next Generation Databases and Contemporary Issues.

Suggested Readings:

1. NoSQL Distilled by Addison-Wesley.
2. Next Generation Databases by Apress Publication.
3. MongoDB: The Definitive Guide by O'Reilly Media.
4. Graph Databases by O'Reilly Media.
5. The Design and Implementation of Modern Column-Oriented Database Systems by Now Publishers Inc.
6. An introduction to Information Retrieval by Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Cambridge University Press.
7. The Design and Implementation of Modern Column-Oriented Database Systems by Daniel Abadi, Peter Boncz and Stavros Harizopoulas, Now Publishers.
8. Next Generation Database: NoSQL and big data by Guy Harrison, Apress.

Useful Video links:

Unit	Topics Covered	NPTEL / Reference Link
Unit-I	Introduction to NoSQL Concepts, ACID & BASE, CAP Theorem, NoSQL Architecture Patterns	https://onlinecourses-archive.nptel.ac.in/noc17_cs33/course
	Distributed Databases, Sharding, Replication, Query Processing	https://onlinecourses.nptel.ac.in/noc24_cs75/preview
	NoSQL Basics and Key-Value Stores	https://www.youtube.com/watch
Unit-II	Key-Value Databases, Document-Oriented Databases, MongoDB, Cassandra	https://www.youtube.com/watch

	Distributed NoSQL Systems and Big Data Storage	https://onlinecourses-archive.nptel.ac.in/noc19_cs33/preview
	CRUD Operations, Replication, Sharding in MongoDB/Cassandra	https://www.coursera.org/learn/introduction-to-nosql-databases/
Unit-III	Columnar Databases, Storage Models, Compression, Query Processing	https://onlinecourses-archive.nptel.ac.in/noc19_cs33/preview
	Indexing, Database Internals, Query Optimization	https://onlinecourses.nptel.ac.in/noc24_cs75/preview
Unit-IV	Graph Databases, Graph Modeling, Cypher Queries	https://onlinecourses-archive.nptel.ac.in/noc17_cs33/course
	Graph Analytics, PageRank, Distributed Graph Processing	https://onlinecourses-archive.nptel.ac.in/noc19_cs33/preview
	Modern NoSQL Trends and Graph-Oriented Databases	https://www.coursera.org/learn/introduction-to-nosql-databases/

Course code	**DS-302A**				
Category	Professional Core Courses				
Course title	**Data Visualization**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to Python-based data handling tools and structured data preparation techniques required for effective visualization. • To develop the ability to create clear, well-structured, and customizable static visualizations for exploratory and explanatory analysis. • To enable students to analyze multivariate and time-oriented data using appropriate statistical and advanced visualization techniques. • To cultivate skills in interactive visualization and data storytelling while emphasizing ethical and responsible visual communication.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall Python libraries, data structures, plotting functions, and basic visualization concepts for exploratory data analysis.	Level 1: Remember
CO2	Explain visualization components, design principles, plot types, and techniques for effective data storytelling and communication.	Level 2: Understand
CO3	Apply Python tools to create, customize, and analyze static and interactive visualizations for datasets using Matplotlib, Seaborn, and Plotly.	Level 3 : Apply
CO4	Analyze datasets visually, compare plotting methods, detect patterns, and interpret multivariate, temporal, and interactive visual insights.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Data Handling Basics: Overview of Python libraries: Pandas, NumPy, Matplotlib, Seaborn, Plotly, Understanding DataFrames in Pandas (structure differences vs R), Data loading using Pandas: from CSV, Excel, JSON, URL, Basic DataFrame manipulations: indexing, slicing, merging, grouping, Introduction to tidy data in Python.

Unit-II

Basics of Visualization Analytics Problems: Key Visualization Concepts, Visualization goals, communication, perception, clarity, Plot components: figure, axes, ticks, labels, legends, themes, Creating basic plots in Matplotlib: line chart, bar chart, pie chart, Customizing plots: colors, markers, grids, annotations, Subplots and layout

management (Matplotlib gridspec, subplot2grid), Color palettes, themes, style settings, Enhanced barplots, countplots, distribution plots, PairGrid, FacetGrid concepts.

Unit-III

Statistical & Multivariate Visualization: Violin plots, Boxen plots, Jointplots & pairplots, Heatmaps for categorical & correlation data, Clustermaps.
Time & Multi-Dimensional Visualization: Multi-axis plots, Rolling window visualization, Bubble charts, spider/radar charts, Area charts, stacked charts.

Unit-IV

Plotly Interactive Visualization: Introduction to Plotly, Interactive line, bar, scatter plots, Plotly Express vs. Plotly Graph Objects, Interactive legends, hover labels, animations, 3D visualizations (surface, scatter3D, mesh plots).
Plotly Interactive Visualization: Visualization for insights vs. aesthetics, Data storytelling principles, Layout design for dashboards (Plotly Dash – conceptual only), Choosing effective chart types, Ethical visualization: misleading charts, scale distortions.

Suggested Readings:

1. Python for Data Analysis by Wes McKinney, O'Reilly Media, 2018.
2. Python Data Science Handbook by Jake VanderPlas, O'Reilly Media, 2016.
3. Python Data Visualization Essentials Guide by Kalilur Rahman, BPB Publications, 2021.
4. Data Visualization with Python and JavaScript by Kyran Dale, O'Reilly Media, 2016.
5. Mastering Matplotlib by Kirthi Raman, Packt Publishing, 2015.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Data Frames in Pandas	https://youtu.be/6DTFIKF8QIg?si=en5tm53K2XQN6Mw9
	Data loading	https://youtu.be/On6rLc1l_MU?si=tZvRvW-7ZL2PKaj7
	Numpy	https://youtu.be/rjY59WLMK2o?si=q92faGhp3hT69w_X
Unit-II	Matplotlib	https://youtu.be/eFByJkA3ti4?si=cJ0ncTkbPsvA2i2p
	Plot components: figure, axes	https://youtu.be/eFByJkA3ti4?si=gcSAChRE0sMu_yIv
Unit-III	Jointplots & pairplots	https://youtu.be/JhK2qVi5dC4?si=0mVubJza7r5s-6xp
	Spider Graph	https://youtu.be/ONtrmxyxTsw?si=xMClNbs2Wb5tjTEZ
Unit-IV	Scatter plots	https://youtu.be/eFByJkA3ti4?si=WAMwmAUPQlirnsI1

Course code	**AI-001A**				
Category	Professional Core Courses				
Course title	**Neural Networks**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	3	1	0	**4**	
Course Objectives	The objectives of this course are ● To provide knowledge of artificial neural networks, neuron models, architectures, and activation functions. ● To develop understanding of neural network learning mechanisms and computational models. ● To enable application of neural network techniques for pattern recognition and problem solving. ● To develop analytical abilities for evaluating neural network performance and learning behaviour.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define artificial neural network concepts, neuron models, activation functions, architectures, and learning paradigms.	Level 1: Remember
CO2	Explain neural network structures, learning algorithms, associative memories, and training mechanisms.	Level 2: Understand
CO3	Apply neural network models and learning techniques to solve classification, prediction, and pattern recognition problems.	Level 3: Apply
CO4	Analyze neural network performance, learning behaviour, memory models, and training outcomes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Overview of biological neurons: Structure of biological neuron, neurobiological analogy, Biological neuron equivalencies to artificial neuron model, Evolution of neural network.
Activation Functions: Threshold functions, Signum function, Sigmoid function, Tan-hyperbolic function, Stochastic function, Ramp function, Linear function, Identity function.
ANN Architecture: Feed forward network, Feed backward network, single and multilayer network, fully recurrent network.

Unit-II

McCulloch and Pits Neural Network (MCP Model): Architecture, Solution of AND, OR function using MCP model.
Hebb Model: Architecture, training and testing, Hebb network for AND function.

Perceptron Network: Architecture, training, Testing, single and multi-output model, Perceptron for AND function Linear function, application of linear model, linear separability, solution of OR function using linear separability model.

Unit-III

Learning: Supervised, Unsupervised, reinforcement learning, Gradient Decent algorithm, generalized delta learning rule, Habbian learning, Competitive learning.
Back propogation Network: Architecture, training and testing.

Unit-IV

Associative memory: Auto associative and Hetero associative memory and their architecture, training (insertion) and testing (Retrieval) algorithm using Hebb rule and Outer Product rule. Storage capacity, Testing of associative memory for missing and mistaken data, Bidirectional memory.

Suggested Readings:

1. Neural Networks: A Comprehensive formulation by Simon Haykin, 1998, AW.
2. Neural Networks by Kosko, 1992, PHI.
3. Neural Network Fundamentals by N.K. Bose, P. Liang, 2002, T.M.H.
4. Neural Network by T.N.Shankar, University Science Press.
5. Neuro Fuzzy Systems by Lamba, V.K., University Science Press.

Useful Video Links

Unit No	Topics	Links
Unit-I	Introduction to Artificial Neural Networks	https://youtu.be/xbYgKoG4x2g?si=iG_Ygz7pTJuCEhIt
	Biological and Artificial Neural Network	https://www.youtube.com/watch?v=0aDq6ax6kGQ
Unit-II	Perceptron	https://youtu.be/tRG-OnnQ9g4?si=vE-g2Xx3ldWghw3R
	Solution of Non-Linearly Separable Problems	https://youtu.be/Fp33mf3L6AE?si=busfaI5LzLX3QZt9
Unit-III	Learning Mechanisms Hebbian, Competitive	https://youtu.be/Zxs-f4HsTDk?si=1YbrAuv_mQaAwAOM
Unit-IV	Associative memory	https://youtu.be/Ccrw9L1DK4g?si=3KIdlhOk3jZQUmWh

<table>
<tr><td>Course Code</td><td colspan="5">CSE-002A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Big Data Analytics</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To provide knowledge of big data concepts, architectures, storage models, and analytical frameworks.
● To develop understanding of distributed computing, data processing, and big data technologies.
● To enable application of big data tools and analytics techniques for large-scale data processing.
● To develop analytical abilities for evaluating big data solutions and business insights.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define big data concepts, architectures, storage mechanisms, distributed computing models, and analytical frameworks.	Level 1: Remember
CO2	Explain big data processing techniques, distributed systems, analytical methods, and supporting technologies.	Level 2: Understand
CO3	Apply big data tools, frameworks, and analytics techniques for processing and analyzing large datasets.	Level 3: Apply
CO4	Analyze big data solutions, analytical outcomes, scalability issues, and performance considerations.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Introduction to Big Data: Big Data: Why and Where, Application and Challenges, Characteristics of Big Data and Dimensions of Scalability, The Six V, Approaches for Analysis of Big Data , Steps in the Data science process, Foundations for Big Data Systems and Programming, Distributed file systems, Role of Data analyst.

Unit II

Data Repositories and Big Data Platforms: RDBMS, NoSQL, Data Marts, Data Lakes, ETL, and Data Pipelines, Introduction to Hadoop Ecosystem, HDFS, Map-Reduce Programming, Understanding Text Analytics and Big Data, Predictive analysis on Big Data, Big Data Processing Tools, Modern Data Ecosystem, Key Players, Types of Data, Understanding Different Types of File Formats, Sources of Data Using Service Bindings.

Unit-III

Introduction to Big Data Modeling and Management: Data Storage, Data Quality, Data Operations, Data Ingestion, Scalability and Security Traditional DBMS and Big Data Management Systems, Real Life Applications, Data Model: Structure, Operations, Constraints, Types of Big Data Model.

Unit-IV

Big Data Integration and processing: Big Data Processing, Retrieving: Data Query and retrieval, Information Integration, Big Data Processing pipelines, Analytical operations, Aggregation operation, High level Operation, Tools and Systems: Big Data workflow Management.

Suggested Readings:

1. Big Data Analytics by Seema Acharya, Subhasini Chellappan, Wiley, 2015
2. Intelligent Data Analysis by Michael Berthold, David J. Hand, Springer, 2007.
3. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC press.
4. Using R to Unlock the Value of Big Data: Big Data by Tom Plunkett, Mark Hornick.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Big Data	https://youtu.be/r5k-_RLIpuA?si=YZ1tzhVmP55jhmWb
	Application and Challenges, Characteristics of Big Data	https://youtu.be/uhj5oKRqY6w?si=CRZtp1M08PBjKeCp
	The Six V, Data Science: Getting Value out of Big Data	https://youtu.be/mI4O4bG39Wo?si=JZndMD7amRilg1Kp
	Distributed file systems.	https://youtu.be/0QIv4kk18Kg?si=l06ISSB1CsbyLdCi
Unit-II	RDBMS, NoSQL, Data Marts, Data Lakes	https://youtu.be/tqD8aVpbD8o?si=7-qLiRcdvOewtMWi
	Modern Data Ecosystem, Key Players, Types of Data	https://youtu.be/fBK_58JUICs?si=Y28CXZDcfy-Wz8ri
	Sources of Data Using Service Bindings	https://youtu.be/G3OwDpYTJPE?si=73Vts0aP2LzOVewl
Unit- III	Data Storage, Data Quality, Data Operations, Data Ingestion	https://youtu.be/0I2QB5Q0EaE?si=TCfP4ypw9QemQbPw
	Scalability and Security Traditional DBMS	https://youtu.be/EUzsy3W4I0g?si=HDz2Ah5zVgBeH62O
	Data Model: Structure, Operations	https://youtu.be/Z2Zx2G02aI4?si=DQttlY4tIZEolUPD
	Types of Big Data Model.	https://youtu.be/-xxCY6WHfRY?si=bdh8TVMHm-dgE2tV
Unit- IV	Big Data Processing	https://youtu.be/YEMGK4BPtHc?si=_7PfT1YWyrhd3Jic
	Retrieving: Data Query and retrieval, Information Integration	https://youtu.be/DJOaFa8xlrs?si=DulEAUkIEoJKgvy5
	Big Data Processing pipelines, Analytical operations,	https://youtu.be/VtzvF17ysbc?si=mmbnnXQ7ZNAbTgvR
	Tools and Systems: Big Data workflow Management	https://youtu.be/Pyo4RWtxsQM?si=TXUQ-p45JnwEJTlL

Course Code	**DS-304A**				
Category	Professional Core Courses				
Course Title	**Social Network Analysis**				
Scheme and Credits	L	T	P	Credits	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To provide knowledge of social networks, graph structures, network measures, and social data analysis concepts. ● To develop understanding of community detection, network evolution, influence analysis, and information diffusion. ● To enable application of social network analysis techniques for discovering patterns and relationships. ● To develop analytical abilities for evaluating social structures, interactions, and network behaviour.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define social network concepts, graph structures, network measures, social interactions, and analytical frameworks.	Level 1: Remember
CO2	Explain community structures, influence models, information diffusion processes, and network evolution mechanisms.	Level 2: Understand
CO3	Apply social network analysis techniques, graph algorithms, and analytical methods to discover patterns and relationships.	Level 3: Apply
CO4	Analyze social networks, community structures, influence propagation, and network behaviour using appropriate analytical techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Basics of Social Network Analysis: Definition and scope of social networks, Types of networks, social, biological, technological, information networks, Real-world applications of network analysis Structure and components of a network.

Tools & Environment: Introduction to Python & Google Colab for network analysis, NetworkX, Creating graphs, Basic graph operations, Visualization basics, Degree, centrality, clustering coefficient, Network density, diameter, average path length, Degree distributions and network properties.

Unit-II

Network Growth Models: How networks evolve, Preferential attachment model, Random graph model, Small-world networks, Importance of link structure, Page Rank & related ranking algorithms, Hubs and Authorities concepts, Graph Visualization, Graph drawing tools, Layout techniques, Large network visualization challenges, Concept of communities/clusters in networks, Modularity, Popular community detection algorithms, Evaluation of communities.

Unit-III

Predictive & Behavioural Analysis in Networks: Predicting missing and future links, Similarity-based measures, Machine-learning approaches for link prediction, Spread of information and influence, Viral diffusion models, Contagion and cascading effects, Influence maximization, Outlier behavior, Fraud detection, Identifying unusual sub-graphs or nodes, Applications in security & social media.

Unit-IV

Graph Representation Learning & Applications: Basics of deep learning relevant to graph data, Challenges with graph-structured input, Node embeddings, Graph embeddings, DeepWalk, Node2Vec, LINE, GNN (Graph Neural Network) basics, Real-world applications of SNA, Social-media analytics, E-commerce networks, Web networks, Final project-style case discussions.

Suggested Readings:

1. Social Network Analysis by Tanmoy Chakraborty, Wiley India (2021).
2. Social Networks and the Semantic Web by Peter Mika, First Edition, Springer 2007.
3. Models and Methods in Social Network Analysis edited by Peter J. Carrington, John Scott & Stanley Wasserman, Cambridge University Press (2005).
4. Social Network Analysis: Methods and Applications by Stanley Wasserman & Katherine Faust, Cambridge University Press (1994).
5. Networks, Crowds, and Markets: Reasoning About a Highly Connected World by David Easley & Jon Kleinberg, Cambridge University Press (2010).
6. Network Science by Albert-László Barabási, Network-Science Book Project (open reference).

Useful Video links:

Topics	**Links**
Social Network Analysis	https://youtu.be/knTTWzLRlEE?si=oZFI6MLRZg3VFYUY

Course Code	**DS-L302A**				
Category	Professional Core Courses				
Course Title	**Data Visualization Lab**				
Scheme and Credits	L	T	P	Credits	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are • To explore Python visualization libraries (Matplotlib, Seaborn, Pandas, Plotly) to represent data effectively. • To visualize trends, distributions, and comparisons using line charts, bar/column charts, pie/donut charts, and histograms. • Analyze relationships and detect patterns through scatter plots, correlation plots, box plots, and violin plots. • To Create advanced visualizations like 3D plots, heatmaps, and stacked charts for complex datasets.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Identify and use major Python data visualization libraries (Matplotlib, Seaborn, Pandas, Plotly) for handling different types of data.	Level 2: Understand
CO2	Apply suitable visualization techniques (line, bar, pie, histogram) to represent trends, categorical data, proportions, and distributions.	Level 3: Apply
CO3	Construct advanced and interactive visualizations including scatter plots, 3D plots, heatmaps, and stacked bar charts using Seaborn and Plotly.	Level 3: Apply
CO4	Analyze multivariate datasets to interpret relationships, correlations, and statistical variations using box plots, violin plots, and correlation plots.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	To study and explore data visualization libraries in Python, including Matplotlib, Seaborn, Pandas, and Plotly.	CO1
2	Write a Python program to visualize data trends over time using line charts.	CO2
3	Write a Python program to compare categorical data using bar charts and column charts.	CO2
4	Write a Python program to represent proportions and percentages using pie charts and donut charts.	CO2
5	Write a Python program to analyze data distribution using histograms.	CO2

6	Write a Python program to identify relationships and correlations between variables using scatter plots and correlation plots.	CO3 CO4
7	Write a Python program to visualize statistical summaries and detect outliers using box plots and violin plots.	CO4
8	Write a Python program to draw 3D plots using the Plotly library.	CO3
9	Write a Python program to generate a 6×6 heatmap using random data and visualize it with Seaborn.	CO3
10	Write a Python program to plot a stacked bar chart displaying sales of multiple products across different quarters.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Visualize data trends over time using line charts	https://colab.research.google.com/github/ageron/handson-ml2/blob/master/tools_matplotlib.ipynb
Represent proportions and percentages using pie charts and donut charts	https://colab.research.google.com/drive/1NsncQ_M5W5F8Z03nOj713Wjf_eW8k0AQ?usp=sharing
Draw 3D plots using the Plotly library	https://colab.research.google.com/drive/1-luSy55lQQrpNhJ_-W_w__rdaBgtNub0?usp=sharing

Course Code	**AI-L001A**				
Category	Professional Core Courses				
Course Title	**Neural Networks Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To introduce the MATLAB environment for designing and simulating neural network models. • To develop understanding of basic neuron models and learning rules such as McCulloch-Pitts and Hebbian learning. • To study and implement various activation functions used in neural networks. • To analyze the effect of weights, bias, and activation functions on neuron behavior. • To implement and evaluate neural network models for solving linearly separable problems and pattern recognition task.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the MATLAB environment and fundamental concepts of neural networks, including neuron models and activation functions.	Level 2: Understand
CO2	Implement basic neural network models such as McCulloch-Pitts, Hebbian learning, and activation functions using MATLAB.	Level 3: Apply
CO3	Apply neural network concepts to analyze the effect of weights, bias, and activation functions on neuron output.	Level 3: Apply
CO4	Analyze and solve linearly separable problems using Perceptron and Hopfield network models.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Study and explore the MATLAB environment for neural network design and simulation.	CO1
2	Write a program to plot and analyze various activation functions such as threshold, signum, sigmoid, tanh, ramp, and identity.	CO1 CO2
3	Implement the McCulloch-Pitts (MCP) neuron model with a suitable example.	CO2
4	Implement the Hebbian learning model and demonstrate its learning process with an example.	CO2
5	Write a program to study basic neuron models and learning algorithms using MATLAB Neural Network Toolbox	CO1 CO2
6	Write a program to study the effect of weights and bias values on the output of a neuron.	CO3
7	Write a program to analyze how different activation functions influence the output of a neuron.	CO3

8	Implement a neural network model to solve a linearly separable problem.	CO3 CO4
9	Write a program to store a pattern (1 1 1 0). Test the network using Discrete Hopfield Net by giving the input with mistakes in First and Second position.	CO4
10	Write a program for solving linearly separable problem using Perceptron Model.	CO3 CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Linearly separable problem using Perceptron Model.	https://cse22-iiith.vlabs.ac.in/exp/perceptron-learning/simulation.html
Test the network using Discrete Hopfield Net	https://cse22-iiith.vlabs.ac.in/exp/pattern-storage-task/simulation.html
Basic neuron models and learning algorithms using MATLAB Neural Network Toolbox.	https://cse22-iiith.vlabs.ac.in/exp/pattern-clustering/simulation.html

Course Code	**CSE-L002A**				
Category	Professional Core Courses				
Course Title	**Big Data Analytics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To provide knowledge of the Hadoop ecosystem, distributed computing, and big data processing frameworks. ● To develop understanding of MapReduce, Pig, and Hive for large-scale data analysis. ● To enable application of big data tools and techniques for solving data-intensive problems. ● To develop analytical abilities for evaluating big data processing methods and outcomes.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Explain Hadoop ecosystem components, distributed computing concepts, and big data processing frameworks. .	Level 2: Understand
CO2	Implement data processing solutions using Hadoop, MapReduce, Pig, and Hive.	Level 3: Apply
CO3	Apply big data techniques for data analysis, querying, filtering, and clustering tasks.	Level 3: Apply
CO4	Analyze big data processing algorithms and evaluate their performance for large-scale datasets.	Level 4: Analyze

List of Experiments:

Sr. No.	**Contents**	**COs**
1	Study and configure Hadoop.	CO1
2	Implement Word Count using MapReduce.	CO2
3	Perform matrix multiplication using MapReduce.	CO2
4	Perform relational operations using Pig.	CO2
5	Perform database operations using Hive.	CO2
6	Implement Bloom Filter using MapReduce.	CO3
7	Find frequent item sets using MapReduce.	CO3
8	Implement clustering (K-Means) using MapReduce.	CO3
9	Implement PageRank algorithm.	CO4

10	Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.	CO4

Note: 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Perform relational operations using pig	https://youtu.be/9_Huva3VVAY?si=w-6ETum5NmaC1tea
Implement Bloom Filter using MapReduce.	https://youtu.be/bD0Xw4sR8kM?si=GCdGOkJXZ1utrs-w
Implement clustering (K-Means) using MapReduce.	https://youtu.be/-ok7BBx_D2Y?si=xLdACQP-s4ZTSpgM
Implement PageRank algorithm.	https://youtu.be/rKWozgedyI4?si=yZ7cySnM1N19f9YA

<table>
<tr><td>Course code</td><td colspan="5">CSE-303A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Formal Languages & Automata</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of automata, formal languages, grammars, and computational models.
To develop understanding of language recognition, parsing, and computational mechanisms.
To enable application of automata and grammar concepts for problem solving.
To develop analytical abilities related to computability, decidability, and complexity.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the concepts, models, grammars, languages, and computational theories related to formal languages and automata.	Level 1: Remember
CO2	Explain the principles, operations, and relationships among automata, grammars, languages, and computational models.	Level 2: Understand
CO3	Apply automata, grammars, and computational models to solve language recognition and processing problems.	Level 3: Apply
CO4	Analyze computational models, language classes, and decidability issues to evaluate computational problems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Nondeterministic finite automata (NDFA), Equivalence of DFA and NDFA, Conversion of NFA to DFA , minimization of finite automata, Finite automata with ϵ- moves, Acceptability of a string by a finite Automata.
Introduction to Machines: Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

Unit-II

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of regular expression, Regular expression conversion to Finite Automata and vice versa.

Properties of regular languages: Regular language, pumping lemma for regular sets/languages, Application of regular languages.

Unit-III

Grammars: Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal, Reduced Forms: Removal of useless symbols, null and unit productions.
Normal Form: Chomsky Normal form (CNF) and Greibach Normal Form (GNF), Push Down Automata: Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

Unit-IV

Turing machines: The basic model for Turing machines (TM), Deterministic and NonDeterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by designed turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.
Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Suggested Readings:

1. Theory of Computer Science: Automata, Languages and Computation by K. L. P. Mishra and N. Chandrashekaran, 2nd Edition, Prentice Hall of India, India, 2003.
2. Fundamentals of the Theory of Computation: Principles and Practice by Raymond Greenlaw and H. James Hoover, Morgan Kaufmann, 1998.
3. Introduction to Languages and Automata Theory by John C. Martin, 3rd Edition, Tata McGraw-Hill, 2007.
4. Introduction to Automata Theory, Languages, and Computation by John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, 3rd Edition, Pearson Education.

Useful Video Link:

Unit No	Topics	Links
Unit-I	Introduction to Automata, Languages and Computation	https://www.youtube.com/watch?v=_2w9UX17m_k&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=1
	Deterministic Finite Automata (DFA)	https://www.youtube.com/watch?v=CwihAY_fgRE&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=2
Unit-II	Regular expression	https://www.youtube.com/watch?v=OA8EY3HKZoc&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=17
	Pumping Lemma	https://www.youtube.com/watch?v=wQbdjmINxNU&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=28
Unit-III	Chomsky Normal Form (CNF)	https://www.youtube.com/watch?v=AnHE1jVpgHA&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=47
Unit-IV	Turning Machine	https://www.youtube.com/watch?v=WYncdAzKMHU&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=60

<table>
<tr><td>Course code</td><td colspan="5">AI-302A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Recommender Systems</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of recommender system concepts, architectures, similarity measures, and recommendation techniques.
To develop understanding of content-based, collaborative, and trust-based recommendation methods.
To enable application of recommender system techniques for personalized information retrieval.
To develop analytical abilities for evaluating recommendation quality and system effectiveness.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">3 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define recommender system concepts, architectures, similarity measures, filtering techniques, and evaluation metrics.	Level 1: Remember
CO2	Explain content-based, collaborative, knowledge-based, and trust-based recommendation approaches.	Level 2: Understand
CO3	Apply recommendation techniques, similarity measures, and filtering algorithms to develop personalized recommendation systems.	Level 3: Apply
CO4	Analyze recommender systems using evaluation strategies, trust models, dimensionality reduction techniques, and recommendation performance measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Recommender Systems: Introduction and basic taxonomy of recommender systems – Traditional and non-personalized Recommender Systems, Overview of data mining methods for recommender systems, similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD), Applications of recommendation systems, Issues with recommender system: The cold-start problem.

Unit-II

Content-based Recommender System: Architecture of Content-based Systems, Advantages and Drawbacks of Content-based Filtering, Content representation and content similarity, Item profiles, discovering features of data, obtaining item features from tags, representing item profiles, Learning User Profiles and Filtering, Similarity-based

retrieval, Classification algorithms, Knowledge base recommendation: Knowledge representation and reasoning, constraint-based recommenders, Case based recommenders.

Unit-III

Collaborative filtering-based Recommender System: Understanding ratings and rating data, User-based nearest-neighbor recommendation: Similarity Function, User-Based Algorithms Item-based nearest neighbour recommendation: Similarity Function, Item-Based Algorithms, Further model-based and preprocessing-based approaches, Comparing User-Based and Item-Based recommendations.

Unit-IV

Evaluating Recommender Systems: Introduction, General properties of evaluation research, Popular evaluation designs, Evaluation on historical datasets, Alternate evaluation designs. Community-Based Web Search- The Collaborative Web Search System. Shared Web Search - The HeyStaks System, The HeyStaks Recommendation Engine. Social Tagging Recommenders Systems- Folksonomy, The Traditional Recommender Systems Paradigm, BibSonomy as Study Case, Tag Acquisition, Trust and Recommendations- Introduction, Computational Trust, Trust-Enhanced Recommender Systems

Suggested Readings:

1. Recommender Systems: An Introduction by Jannach D., Zanker M. and FelFering A, Cambridge University Press, 1st ed., 2011.
2. Recommender Systems Handbook by Ricci F., Rokach L., Shapira D., Kantor B.P., Springer, 1st ed., 2011.
3. Building Recommendation Engines by Suresh Kumar Gorakala, Packt Publishing, 2016.
4. Recommender Systems: The Textbook by Aggarwal, C. C., Springer, 2016.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Overview of Recommender Systems	https://youtu.be/1JRrCEgiyHM?si=TI92GD7dKaLgUynP
	Dimensionality Reduction - Introduction	https://youtu.be/yLdOS6xyM_Q?si=IcKoxrbDJ4PVpRgy
Unit-II	Content Based Recommendations	https://youtu.be/2uxXPzm-7FY?si=5MOXAIK8XazWx5Em
Unit-III	Collaborative Filtering	https://youtu.be/h9gpufJFF-0?si=7hmFo4D9QimbfN6g
	Implementing Collaborative Filtering	https://youtu.be/6BTLobS7AU8?si=lUZLC1J8GfEiRG1y
Unit-IV	Evaluating Recommender Systems	https://youtu.be/VZKMyTaLI00?si=cQMi302X8yMgDLV5

Course Code	**AI-306A**				
Category	Professional Elective Courses				
Course Title	**Explainable AI**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE-AIML/CSE-DS)**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To provide knowledge of explainable AI concepts, interpretability methods, and transparency mechanisms. ● To develop understanding of model explanation techniques and trustworthy AI practices. ● To enable application of explainability methods for interpreting AI models. ● To develop analytical abilities for evaluating transparency, fairness, and trustworthiness of AI systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	**Skills Demonstrated**	**RBT Level**
CO1	Define explainable AI concepts, interpretability methods, transparency principles, and trustworthy AI mechanisms.	Level 1: Remember
CO2	Explain model explanation techniques, interpretability approaches, and evaluation methods used in explainable AI.	Level 2: Understand
CO3	Apply explainability techniques to interpret machine learning and AI model behaviour.	Level 3: Apply
CO4	Analyze AI systems for transparency, interpretability, fairness, accountability, and trustworthiness.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Explainable AI: Science of Interpretable Machine Learning, Motivation, Challenges, and Mythos of Model Interpretability, Human Factors in Explainability, Interpreting Interpretability. Fundamentals of XAI, Categorization of XAI, Taxonomy of XAI methods for Machine Learning, Machine Learning interpretability, Causal model induction, Causality learning, XAI techniques and limitations.

Unit-II

Post hoc Explanations: Explaining the Predictions of Any Classifier, Pitfalls, Challenges, and Evaluation of Feature Attributions, LIME and SHAP, OpenXAI, The Disagreement Problem in Explainable Machine Learning, Counterfactual Explanations (or) Algorithmic Recourse, Learning Model-Agnostic Counterfactual Explanations for Tabular Data.

Unit-III

Attention and Concept Based Explanations: Quantifying Interpretability of Deep Visual Representations, Interpretability Beyond Feature Attribution, Data Attribution and Interactive Explanation, Equitable Valuation of Data, Explainable Active Learning (XAL), Theory of Explainability and Interpreting Generative Models.

Unit-IV

Explainability for Fair Machine Learning: Connections with Robustness, Privacy, Fairness, and Unlearning, Right to Explanation and the Right to be Forgotten, Fairness via Explanation Quality, Mechanistic Interpretability and Compiled Transformers, Understanding and Reasoning in Large Language Models.

Suggested Readings:

1. Explainable AI for Practitioners by Michael Munn, David Pitman, O'Reilly Media Inc., 2022.
2. Explainable AI with Python by Leonida Gianfagna, Antonio Di Cecco, Springer, 2021.
3. Interpretable Machine Learning, A Guide for Making Black Box Models Explainable by Christoph Molnar, Leanpub, 2023.
4. Hands-On Explainable AI (XAI) with Python: Interpret, visualize, explain, and integrate reliable AI for fair, secure, and trustworthy AI apps by Denis Rothman Packet Publishing Limited, 2020.
5. Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning by Uday Kamath and John Liu, Springer, ISBN 9783030833558.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Explainable AI	https://youtu.be/McviMUYiG9s?si=p5OVqjLWD-il9fl5
	Machine Learning interpretability	https://youtu.be/Rgscjp0qsmg?si=5UfNUsGA5d955l7m
Unit-II	LIME and SHAP	https://youtu.be/YZwDizPBFaM?si=TCPd-g71jKqUWe9L
	Counterfactual explanations	https://youtu.be/8r-1JBWBycQ?si=TmWJMCOu8BP4dA0_
Unit-III	Quantifying Interpretability of Deep Visual Representations	https://youtu.be/Xy6RcjXMa2c?si=4x977_uUEtERZXzw
Unit-IV	Reasoning in Large Language Models	https://youtu.be/6-tv6tEprVI?si=NRTHP-FQo9Xoo0D_

<table>
<tr><td>Course code</td><td colspan="5">CSE-308A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Digital Image Processing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of digital image processing concepts, image representation, and transformation techniques.
To develop understanding of image enhancement, restoration, segmentation, and feature extraction methods.
To enable application of image processing techniques for image analysis and interpretation.
To develop analytical abilities for evaluating image processing algorithms and outcomes.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define digital image processing concepts, image models, transformations, enhancement techniques, and feature extraction methods.	Level 1: Remember
CO2	Explain operation of image transformation, enhancement, restoration, compression, segmentation, representation techniques and analysis procedures.	Level 2: Understand
CO3	Apply image processing techniques for image enhancement, segmentation, feature extraction, and analysis.	Level 3 : Apply
CO4	Analyze image processing algorithms, segmentation results, feature representations, and image interpretation outcomes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

Unit-II

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms. **Image Restoration:** Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering.

Unit-III

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-IV

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested Readings:

1. Digital Image Processing by Rafael C. Gonzalez, Richard E. Woods, Pearson, 3rd Edition, 2010.
2. Fundamentals of Digital Image Processing by Anil K. Jain, Pearson, 2002.
3. Digital Image Processing by Kenneth R. Castleman, Pearson, 2006.
4. Multidimensional Digital Signal Processing by D, E. Dudgeon and RM. Mersereau, Prentice Hall Professional Technical Reference, 1990.
5. Digital Image Processing by William K. Pratt, John Wiley, New York, 2002.

Useful Video Links:

Unit	Topic	NPTEL Video Lecture Link
Unit-I	Introduction to Digital Image Processing	https://digimat.in/nptel/courses/video/117105135/L01.html
	Image Digitalization, Sampling & Quantization	https://digimat.in/nptel/courses/video/117105135/L03.html
	Color Fundamentals & Image Representation	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
Unit-II	Histogram Processing	https://digimat.in/nptel/courses/video/117105135/L34.html
	Histogram Equalization & Specification	https://digimat.in/nptel/courses/video/117105135/L35.html
	Fourier Transform – I	https://www.youtube.com/watch?v=11b5NnpEoVE
	Image Transformations & Frequency Domain	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_7/7_intro.html
Unit-III	Image Compression Fundamentals	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_7/7_intro.html
	JPEG Compression	https://onlinecourses-archive.nptel.ac.in/noc18_ee40/preview
	Coding Redundancy & Huffman Coding	https://digimat.in/nptel/courses/video/117105135/117105135.html
Unit-IV	Edge Detection & Boundary Detection	https://digimat.in/nptel/courses/video/117105135/117105135.html
	Thresholding & Segmentation	https://arxiv.org/abs/1909.05084
	Hough Transform & Region Based Segmentation	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
	Boundary Representation & Descriptors	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_1/1_intro.html

Annexure AC / 5.12

Course code	**OEC-03A**				
Course Category	Multidisciplinary Open Elective				
Course title	**Internet of Things and Edge Computing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals, architecture, and applications of Internet of Things (IoT) and edge computing. • To provide knowledge of IoT devices, sensors, communication protocols, and ESP32-based systems. • To familiarize with cloud connectivity, Things Board, and IoT data visualization techniques. • To present the concepts of edge computing and their integration in IoT applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamentals of Internet of Things and edge computing.	Level 1: Remember
CO2	Explain IoT devices, communication technologies, cloud platforms, and edge computing.	Level 2: Understand
CO3	Apply IoT hardware, cloud platforms, and edge computing to develop IoT solutions.	Level 3 : Apply
CO4	Analyze IoT architectures, communication technologies, and edge computing for engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Internet of Things (IoT): Definition and significance of IoT, Evolution of IoT, Components of IoT ecosystem, IoT applications in various engineering domains. Basic Electronic components, sensors, actuators, and controllers. Development boards: Arduino Uno, ESP8266, and ESP32. Introduction to sensor and actuator Ultrasonic, PIR, LDR, IR, DHT11, RFID, MQ series sensors, Servo Motor, LED, and Relay.

Unit-II

IoT Technologies and Protocols: Understanding the Fundamentals of Industrial connectivity and Communication Protocols MQTT, CoAP, HTTP, IOT Wireless Communication Standards-Wi-Fi, Zigbee, LORA, Bluetooth, ESP32 introduction, Architecture, Pin Details, Setup with Arduino, Code uploading, Sensor interfacing with ESP32 and testing.

Unit-III

Cloud Connectivity &Introduction to Thingsboard: Architecture, components and cloud-based features, Key concepts, applications, and technologies, Introduction to Widgets and Creating customizing Dashboards, sending telemetry and attributes from devices, Building and Visualizing Dashboards, Common widgets like charts, maps,

and tables for data visualization, Setting up Real-time Data Monitoring updates and alerts. Small IOT project on Things board.

Unit-IV

Fundamentals of Edge Computing: Distributed systems and edge computing core concepts, Edge computing architectures, IoT devices and edge computing in IoT gateways, Edge computing vs cloud computing vs fog computing. Sensors & Actuators: Working with GPIO pins, analog-to-digital converters (ADC), and physical computing.

Suggested Readings:

1. Internet of Things: A Hands-On Approach by B. Ray, Springer, 2020.
2. Interconnecting Smart Objects with IP: The Next Internet by A. Dunkels, Morgan Kaufmann, 2010.
3. Internet of Things: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
4. Designing the Internet of Things by Adrian McEwen and Hakim Cassimally, Wiley, 2014.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to IOT	https://youtu.be/p7kYStiASLo?si=3HFZbofjAsy5oZCU
	IOT Sensing and Actuation	https://youtu.be/hv-aBonZMRQ?si=x40BUTJOtKy6TZfV
Unit-II	IOT Technologies	https://youtu.be/TrFaCBV7joY?si=U4HlpRE5oXYUmlFy
	IOT Protocols	https://youtu.be/u4UebEMMkJc?si=WB08KtDs9l4ARqzK
Unit-III	Overview of Cloud Computing	https://youtu.be/w2caA8ty36s?si=5WQVhV28wFCIAlFA
	Introduction to Thingsboard	https://youtu.be/80L0ubQLXsc?si=W2zjXWUM86OMoJ9R
Unit-IV	Fundamentals of Edge Computing	https://youtu.be/nPOUoJavYQc?si=pV-YVECWVD-chZtC
	Introduction to Fog Computing	https://www.youtube.com/watch?v=E19Dy_iACFI

Annexure AC / 5.13 ~~4.5~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

(An Autonomous Institute)

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations

(Under NEP-2020)

B-SCHEME

Bachelor of Technology Computer Science and Engineering (CSE)

Common With

Bachelor of Technology Computer Science and Engineering-Working Professional (CSE-WP)

Bachelor of Technology Computer Science and Engineering-Artificial Intelligence and Machine Learning (CSE-AIML)

Bachelor of Technology Computer Science and Engineering-Data Science (CSE-DS)

Effective from the Session 2026-27 (From 2nd Year onwards)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	2 Practical (P) per week	1 Credit
4	2 Seminar/Industrial Training per week	1 Credit

2. RANGE OF CREDIT

A range of credits from 160 to 170 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	73*
2	Professional Elective Courses (Relevant to chosen specialization/branch)	12*
3	Engineering Science Courses	26*
4	Basic Science Courses	21*
5	Humanities and Social Sciences including Management courses	12*
6	Multidisciplinary Open Electives Courses	9*
7	Project work, seminar and internship in industry or appropriate work place/academic and research institutions in India/abroad	16*
8	Value Added Courses	01*
9	Mandatory Non Credit Courses – Audit Course	Non Credit
	Total Credits	170*

***Minor variation is allowed as per need of the respective disciplines*

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses	PEC
3	Engineering Science Courses	ESC
4	Basic Science Courses	BSC
5	Humanities and Social Sciences including Management courses	HSMC
6	Multidisciplinary Open Electives Courses	MOEC
7	Value Added Courses	VAC
8	Project	PR
9	Mandatory Courses	MC
10	Lab Courses	LC
11	Practical Training	PT
12	Internship	INT

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Computer Science and Engineering – 3rd Semester

Common with

B.Tech Computer Science and Engineering-Working Professional – 3rd Semester

B.Tech (CSE- Artificial Intelligence and Machine Learning) – 3rd Semester

B.Tech (CSE – Data Science) – 3rd Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Basic Science Courses	AS-001B	Engineering Mathematics-III	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	CSE-201B	Data Structures	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	CSE-203B	Operating Systems	3	0	0	3	3	30	45		75	3
4	Professional Core Courses	CSE-205B	Python Programming	3	0	0	3	3	30	45		75	3
5	Humanities and Social Science including Management Courses	HSMC-01B	Fundamentals of Management and Organizational Behaviour	3	0	0	3	3	30	45		75	3
6	Engineering Science Courses	ECE-001B	Digital Electronics	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	CSE-L201B	Data Structures Lab Using C	0	0	2	2	1	10		15	25	3
8	Professional Core Courses	CSE-L203B	Operating Systems Lab	0	0	2	2	1	10		15	25	3
9	Professional Core Courses	CSE-L205B	Python Programming Lab	0	0	2	2	1	10		15	25	3
10	Engineering Science Courses	ECE-L001B	Digital Electronics Lab	0	0	2	2	1	10		15	25	3
11	Mandatory Courses (Non-Credit)	MC-201B	Environmental Science	2	0	0	2	-	20	30		-	3
Total Credits								**23**				**575**	

Note: MC-201B is a mandatory non–credit course in which the students will be required passing marks in theory.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Computer Science and Engineering – 4th Semester

Common with

B.Tech Computer Science and Engineering-Working Professional – 4th Semester

B.Tech (CSE- Artificial Intelligence and Machine Learning) – 4th Semester

B.Tech (CSE – Data Science) – 4th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	CSE-202B	Discrete Mathematics	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	CSE-204B	Computer Organization and Architecture	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	CSE-206B	Object Oriented Programming	3	0	0	3	3	30	45		75	3
4	Professional Core Courses	CSE-208B	Database Management Systems	3	1	0	4	4	40	60		100	3
5	Professional Core Courses	CSE-210B	Artificial Intelligence	3	0	0	3	3	30	45		75	3
6	Professional Elective Courses	Refer Professional Elective Table-1	Professional Elective-I	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	CSE-L206B	Object Oriented Programming Lab using C++	0	0	2	2	1	10		15	25	3
8	Professional Core Courses	CSE-L208B	Database Management Systems Lab	0	0	2	2	1	10		15	25	3
9	Professional Core Courses	CSE-L210B	Artificial Intelligence Lab using Python	0	0	2	2	1	10		15	25	3
Total Credits								**23**				**575**	

Notes:

I. Students must choose one course from the Professional Elective–I category (Table I). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

II. At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

III. **For Working Professionals:** Students shall submit a Training/Project Report based on their work in their respective company/organization for the period of the summer/industrial training. The evaluation shall be carried out in the 5th Semester.

Table I: Professional Elective - I

Sr. No.	Course Code	Course Title
1	CSE-212B	Cloud Computing
2	CSE-214B	Nature Inspired Computing Techniques
3	CSE-216B	Human Computer Interaction
4	CSE-218B	Fundamentals of Multimedia
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)

Course Code	**AS-001B**				
Category	Basic Science Courses				
Course Title	**Engineering Mathematics-III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are ● To equip students with advanced mathematical tools—multivariable calculus, vector calculus, partial differential equations, and complex analysis—for modeling, analyzing, and solving problems in computational and engineering domains. ● To emphasise on applications in areas such as image processing, machine learning, signal processing, and system dynamics.				
Course Prerequisite	Mathematics up to 12th Standard and Engineering Mathematics-I				
Assessment	40Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Describe key terminology of multivariable integrals, vector calculus, partial derivatives and complex analysis.	Level 2: Understand
CO2	Explain the principles and applications of multivariable integrals, vector calculus, partial derivatives and functions of complex variables.	Level 2: Understand
CO3	Solve the problems using techniques of integrals, vector calculus, partial derivatives and complex analysis.	Level 3: Apply
CO4	Analyze complex mathematical problems associated with multi-variable integrals, vector calculus, partial derivatives and complex function.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Multivariable Integral Calculus: Evaluation of definite and improper integrals, double integrals, Evaluation of double integrals (Cartesian and polar coordinates), Change of order of integration, Change of variables between Cartesian, cylindrical and spherical polar coordinates, Applications of double integral to find area enclosed by plane curves, Triple integrals, Applications of triple integrals, Beta and Gamma functions.

Unit-II

Vector Calculus: Differentiation of vectors, scalar and vector point functions, Gradient of a scalar point function, Directional derivative, Curl and divergence, Statement of Green's, Stoke's and Gauss divergence theorems, Verification and evaluation of vector integrals using these theorems.

Unit-III

Partial Derivatives: Definition of Partial Differential Equations, First order linear partial differential equations, Partial Differential Equations of higher order: Second-order linear partial differential equations and their classification, Solution to homogeneous and non-homogeneous linear partial differential equations of second order by complementary function and particular integral method, Initial and boundary conditions, D'Alembert's solution of the wave equation, Separation of variables method to simple problems in Cartesian coordinates, One dimensional diffusion equation and its solution by separation of variables.

Unit-IV

Functions of Complex Variable: Differentiability and Analyticity, Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations, Harmonic functions, Integration of complex functions, Cauchy-integral theorem and formula (without proof), Taylor's series, Laurent's series, Zeros of analytic functions, Singularities, Residues, Cauchy Residue theorem (without proof).

Suggested Readings:

1. Higher Engineering Mathematics by B.V. Ramana, TataMcGraw-Hill Publishing Company Limited.
2. Higher Engineering Mathematics by B.S. Grewal, KhannaPublishers.
3. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley& Sons.
4. Advanced Engineering Mathematics by H.K. Dass, S.Chand.
5. A text book of Engineering Mathematics by N.P.Bali and Manish Goyal, Laxmi Publications.
6. Engineering Mathematics for first year by T. Veerarajan, Tata McGraw-Hill Publishing Company Ltd..
7. Engineering Mathematics-Calculus, Differential Equations and Linear Algebra by P. Sivaramakrishna Das, C. Vijayakumari, Pearson Education.

Useful Video links

Unit No.	Topics	Links
Unit-I	Multiple Integrals	https://youtu.be/mIeeVrv447s?si=ZxrHvWcK3RQTaOyp
	Change Order Of Integration	https://youtu.be/4rc3w1sGoNU?si=GmMACWg459ppFGyn
	Change Of Variables	https://youtu.be/wtY5fx6VMGQ?si=bSR0rySP3bql6Ngh
Unit-II	Vector Differentiation	https://youtu.be/Qj0KM9Uh7xw?si=9gLE1lLBgoYnyi8v
	Gradient of a scalar field and Directional derivative	https://youtu.be/JTJXHcLrxgM?si=kuqQlxeT4Y0N9Xeo
	Gradient, Divergence and Curl	https://youtu.be/v_sTlDeCUdU?si=yf6yzC0hazmWzYEh
	Line Integral	https://youtu.be/yCqLvRiVtng?si=iqbOrl9Bq28F9HIL
	Applications of Line integrals	https://youtu.be/mMBSb_dtkYU?si=rtFe1esglErwBr3b
	Green's Theorem	https://youtu.be/34aX-fNMS-c?si=v1hj0iSsVQ2ypsJp
	Divergence Theorem of Gauss	https://youtu.be/DtqTXJ5X3xo?si=J5KIjrjWImISylNH
	Stoke's Theorem	https://youtu.be/q-fgRrPayJY?si=MI5sFHwamcF8gApa
Unit-III	Definition of Partial Differential Equations.	https://youtu.be/Kk5SEzASkZU?feature=shared
	Homogeneous and non-homogenous linear partial differential equations of second order	https://youtu.be/Kk5SEzASkZU?feature=shared
	Initial and boundary conditions of partial differential equations of second order	https://youtu.be/Kk5SEzASkZU?feature=shared
	Separation of variables method to simple problems in Cartesian coordinates.	https://youtu.be/Kk5SEzASkZU?feature=shared
Unit-IV	Introduction to Complex Numbers	https://www.youtube.com/watch?v=gFjlBKW8aZU
	Analytic Functions Of A Complex variable	https://youtu.be/b5VUnapu-qs?si=odZ34Xpop2x-xcob https://www.youtube.com/watch?v=q01b-lV6y5Q
	Calculus Of Residues(Part I)	https://youtu.be/o77UV7YrWvw?si=9T5nTIJ3krNNYKx4
	Calculus Of Residues(Part II)	https://youtu.be/Aq6K0lmv3Qw?si=rWyCcSJMlEVpimr6

<table>
<tr><td>Course code</td><td colspan="5">CSE-201B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Data Structures</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To introduce the basics of data structures and algorithms.
• To explain the concept of Stacks, Queues, Linked Lists, Trees, related operations and their implementation.
• To understand sorting, hashing, and graph algorithms, including their design and complexity analysis
• To develop the ability to evaluate algorithm efficiency in terms of time and space complexity.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated
CO1	Define the fundamental concepts, terminology, and operations of data structures.
CO2	Explain the principles and techniques used in data structures and algorithms.
CO3	Apply appropriate data and algorithms to solve computational problems effectively.
CO4	Analyze the performance of data structures and algorithms using complexity measures.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Basic Terminologies: Concept of Data Structure, Choice of right Data Structure, Algorithms, how to design and develop algorithm, Complexity of algorithm. Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Searching: Linear Search and Binary Search Techniques and their complexity analysis. Arrays: Array Definition, Types, Operations on array and their complexity analysis.

Unit-II

Stacks and Queues: Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation -corresponding algorithms and complexity analysis. Tower of Hanoi problem. Queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

Unit-III

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.
Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Path length, Huffman's algorithm, Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Unit-IV

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.
Graph: Basic Terminologies, Sequential representation of graphs, Adjacency matrices. Graph search and traversal algorithms and complexity analysis.

Suggested Readings:

1. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press. Programming in ANSI C by E. Balaguruswamy, Tata McGraw-Hill
2. Algorithms, Data Structures, and Problem Solving with C++, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
3. How to Solve it by Computer, 2nd Impression by R.G. Dromey, Pearson Education.
4. Data Structures and Algorithms Made Easy by NarasimhaKarumanchi.
5. Data Structures Using C by Aaron M.

Useful Video Links

Unit No.	Topics	Links
Unit-I	Introduction to Data Structures and Algorithms	https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F
	Linear Search Algorithm	https://www.youtube.com/watch?v=C46QfTjVCNU
	Binary Search	https://www.youtube.com/watch?v=V_T5NuccwRA
Unit-II	Stacks	https://youtu.be/g1USSZVWDsY?list=PLBF3763AF2E1C572F
	Stack and its Applications	https://www.youtube.com/watch?v=aG0HjeXBUDU
	Queues and Linked Lists	https://youtu.be/PGWZUgzDMYI?list=PLBF3763AF2E1C572F
Unit-III	Linked Lists-I	https://www.youtube.com/watch?v=K7VIKlUdo20
	Trees	https://youtu.be/tORLeHHtazM?list=PLBF3763AF2E1C572F
	Search Trees-II	https://www.youtube.com/watch?v=5jQGqaAUzOI
	AVL Trees	https://youtu.be/mRGQylRWAsI?list=PLBF3763AF2E1C572F
Unit-IV	Sorting	https://youtu.be/4OxBvBXon5w?list=PLBF3763AF2E1C572F
	Hashing	https://www.youtube.com/watch?v=2-h9193Ztqg
	Graphs	https://youtu.be/9zpSs845wf8?list=PLBF3763AF2E1C572F

<table>
<tr><td>Course Code</td><td colspan="5">CSE-203B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Operating Systems</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To introduce the fundamental concepts and services of operating systems.
● To provide knowledge of process, memory, and file management techniques.
● To familiarize students with synchronization, scheduling, and resource management mechanisms.
● To develop understanding of operating system design and performance issues.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, terminology, and components of operating systems.	Level 1: Remember
CO2	Explain the principles, techniques, and mechanisms used in operating systems.	Level 2: Understand
CO3	Apply operating system techniques for process, memory, file, and resource management.	Level 3: Apply
CO4	Analyze operating system algorithms and mechanisms for efficient system performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Operating Systems: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Architecture (Windows, Android, macOS), OS Services. Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.
Thread: Definition, Various states, Benefits of threads, Types of threads, Multithreading.
Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, SRTF, RR Scheduling.

Unit-II

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc.
Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Unit-III

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging, Memory Protection (ASLR, DEP).
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: First in First Out (FIFO), Optimal Page Replacement and Least Recently used (LRU).

Unit-IV

File Management: Concept of File, Access methods, File types, Modern file system (ZFS, Btrfs, APFS), File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), efficiency and performance.
Disk Management: Disk structure, Disk scheduling – FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks, Case study on UNIX and WINDOWS Operating System.

Suggested Readings:

1. Operating System Concepts by Abraham Silberschatz, Peter B. Galvin, G. Gagne, Eighth edition, Wiley Publication.
2. Modern Operating Systems by Andrew S. Tanenbaum, Second Edition, Pearson India.
3. Operating System: A Design-oriented Approach by Charles Crowley, McGraw Hill Education.
4. Design of the Unix Operating Systems by Maurice Bach, Pearson Education India.

Useful Video links

Unit No.	Topics	Links
Unit-I	Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems	https://www.youtube.com/playlist?list=PLrpK1inhO61UQRHHuB8xSYulwJrAuVGPw
	Multithreading	https://www.youtube.com/watch?v=6rYOyIGfy3w&t=1440s
Unit-II	Critical Section, other Synchronization Problems	https://youtu.be/qKPCfuZAAEc
	Deadlocks, Resources, System State, Necessary and Sufficient conditions for a Deadlock.	https://www.youtube.com/watch?v=8ZS7xzWPo5A&list=PLEAYkSg4uSQ2Pach478muxnoeTNz_QeUJ&index=33
	Banker's algorithm	https://youtu.be/8ZS7xzWPo5A?list=PLyqSpQzTE6M9SYI5RqwFYtFYab94gJpWk
Unit-III	Memory Management	https://youtu.be/_pKbqFyG03s
	Virtual Memory	https://www.youtube.com/watch?v=Ev4BET3i5R0
	Page Replacement algorithms	https://www.youtube.com/watch?v=Oho3QU-7pB8
Unit-IV	File Management	https://youtu.be/EiFHM-HhsEQ
	File Access Methods	https://archive.nptel.ac.in/courses/106/105/106105214/#
	Unix and Windows	https://www.youtube.com/watch?v=6El3RW9ZOKE

Course Code	**CSE-205B**				
Category	Professional Core Courses				
Course Title	**Python Programming**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the fundamentals of Python programming. ● To provide knowledge of Python programming constructs and data structures. ● To familiarize students with Python libraries for data processing and analysis. ● To develop programming skills for graphical and GUI-based applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

Cos	**Skill Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, terminology, and programming constructs of Python.	Level 1: Remember
CO2	Explain the functionality of Python programming constructs, data handling techniques, and graphical modules.	Level 2: Understand
CO3	Use Python programs for data processing, file handling, numerical computing, graphics, and GUI applications.	Level 3: Apply
CO4	Analyze Python programming constructs, data structures, libraries, graphics, image processing, and GUI techniques to solve real-world problems effectively.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Installing Python; basic syntax, interactive shell, editing, saving, and running a script; data types; variables, assignments; numerical types; arithmetic operators and expressions; Loops and selection statements, Control statements String manipulations: subscript operator, indexing, slicing a string; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file.

Unit-II

Lists, Tuple, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; Tuple: creating tuples, accessing elements, tuple immutability, operations, tuple methods, tuples vs. lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries. Hiding redundancy, complexity; arguments and return values; Program structure and design. Recursive functions.

Unit-III

Introduction to NumPy: NumPy arrays, Array Indexing and Slicing, Array Operations, Array Manipulation, Linear Algebra with NumPy, Random Number Generation and Statistics.
Introduction to Pandas: Pandas Series, Pandas Data Frames, Data Frame Indexing and Selection, Data Cleaning and Pre-processing, Data Manipulation, Group by Operations, Merging, Joining, and Concatenating Data Frames, Input/output Operations.

Unit-IV

Simple graphics and image processing: Simple graphics, Turtle operations, Manipulating turtle screen, Drawing two dimensional shapes, examining an object attributes, Taking a random walk, Colour and RGB scheme, Image processing: Image manipulation operations, properties of images, image module, copying, blurring and reducing image.
Graphical User Interfaces using Tkinter: Terminal based and GUI based programs, Introduction to Tkinter, Simple GUI-Based Programs, Windows and Window Components, Input and Output with Entry Fields, Defining and Using Instance Variables, Other Useful GUI Resources.

Suggested Readings:

1. Fundamentals of Python: First Programs by Kenneth Lambert, Course Technology, Cengage Learning, 2012.
2. Introduction to Computer Science Using Python: A Computational Problem-Solving by Dierbach, C. Focus, John Wiley & Sons, 2012.
3. Let Us Python by, Kanetkar, A., &Kanetkar, Y., BPB Publications.
4. Python – The Complete Reference by Brown, M. C., McGraw Hill Education.
5. Core Python Programming by Rao, R. N., Dream Tech Press.
6. Python Programming: Using Problem Solving Approach byThareja, R., Oxford University Press.
7. Python Programming by Sridhar, S., Indumathi, J., &Hariharan, V. M., Pearson Education.
8. Python for Data Analysis by Wes McKinney, 3rd Edition, O'Reilly Media, 2022.
9. Python Data Science Handbook by Jake VanderPlas, O'Reilly Media.

Useful Video links

Unit No.	Topics	Links
Unit-I	Variables and Input Statement	https://youtu.be/ruQb8jzkGyQ
	Data Types, Operators and Expressions	https://youtu.be/8n4MbjuDBu4
	Introduction to for loop	https://youtu.be/lvXuQ_x7EsI
	Introduction to while loop	https://youtu.be/KTvVNN7ia8o
	String Methods	https://youtu.be/p-4HU1rcG5s
	Reading and Writing to a File	https://www.youtube.com/watch?v=rYLJaAdgLhI
	Creating and reading a formatted file	https://www.youtube.com/watch?v=NBTSDtBy5bs
Unit-II	List operators	https://youtu.be/jMShssechMI
	Searching and sorting lists	https://youtu.be/4OxBvBXon5w
	Tuples	https://youtu.be/mzx74TdGYbg
	Dictionary literals, adding, and removing elements	https://youtu.be/Aj7PwBI99A4
	Recursive functions	https://youtu.be/Uo7RyqJaaRQ
Unit-III	NumPy	https://youtu.be/rjY59WLMK2o
	Pandas	https://youtu.be/6DTFIKF8QIg?feature=shared
Unit-IV	Simple graphics	https://www.youtube.com/watch?v=pxKu2pQ7Ilo
	Graphical User Interfaces using Tkinter	https://youtu.be/-GhzpvvIXlM?si=itHn2839Kkhy89B3

<table>
<tr><td>Course Code</td><td colspan="5">HSMC-01B</td></tr>
<tr><td>Category</td><td colspan="5">Humanities and Social Science including Management Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Fundamentals of Management and Organizational Behaviour</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III/IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
Introduce students to foundational management theories, functions, and organizational concepts to build a strong conceptual framework.
Develop understanding of individual and group behavior, motivation, communication, and leadership in organizational settings.
Equip students with practical skills to manage interpersonal processes, conflicts, and team dynamics effectively.
Foster critical analysis of organizational structures, cultures, and change mechanisms to enhance adaptability and effectiveness in organizations.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental management concepts, functions, organizational processes, and organizational behavior elements.	Level 1: Remember
CO2	Explain the roles, skills, and interrelationships in management, individual behaviors, group dynamics, and communication processes within organizations.	Level 2: Understand
CO3	Apply principles of management, motivation techniques, leadership styles, and conflict management strategies to solve organizational behavior challenges.	Level 3: Apply
CO4	Analyze organizational structure, culture, change processes, and behavioral dynamics to support effective decision-making and organizational development.	Level 4: Analyse

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction of Management: Meaning, Definitions, Nature of Management; Managerial Levels, Skills and Roles in an Organization.

Functions of Management: Planning, Organizing, Staffing, Directing& Controlling, Interrelationship of Managerial Functions, Scope of Management, Importance of Management, Difference between Management and Administration.

Unit-II

Introduction of Organization: Meaning and Process of Organization, Management v/s Organization.
Fundamentals of Organizational Behavior: Concepts, Evolution, Importance and Relationship with otherFields, Contemporary Challenges and Opportunities of OB**.**
Individual Processes and Behavior: Personality, Concept, Determinants and Applications.
Perception: Concept, Process and Applications
Learning: Brief Introduction
Motivation: Concept, Techniques and Importance**.**

Unit-III

Interpersonal Processes: Teams and Groups, Definition of Group, Stages of Group Development, Types of Groups, Meaning of Team, Merits and Demerits of Team, Difference between Team and Group, Conflict- Concept, Sources, Types, Management of Conflict.
Leadership: Concept, Function, Styles, Qualities of Leadership.
Communication: Meaning, Process, Channels of Communication, Importance and Barriers of Communication.

Unit-IV

Organizational Processes: Organizational Structure, Meaning and Types of Organizational Structure and their effect on Human Behavior.
Organizational Culture: Elements, Types and Factors affecting Organizational Culture.
Organizational Change: Concept, Types and Factors affecting Organizational Change, Resistance to Change.

Suggested Readings:

1. Fundamentals of Management by Robbins, S.P. and Decenzo, Pearson Education, New Delhi.
2. Organizational Behaviour by Robbins, S.P. & Judge, T.A., Prentice Hall of India, New Delhi.
3. Management concept practice and cases by GhumanKarminder, Aswathappa K., Tata McGraw Hill, New Delhi.
4. Fundamental of Management by Chhabra T. N., Sun India Publications, New Delhi.
5. Organizational Behaviour by Stephen P Robin, Pearson Education.
6. Organizational Behaviour by McShane, Steven L, Tata McGraw Hill, New Delhi.
7. Organizational Behaviour by FC Sharma, Shree Mahavir Publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Nature and Scope of Management	https://nptel.ac.in/courses/110105146
Unit-II	Perception and Personality	https://nptel.ac.in/courses/110103433
Unit-III	Group Dynamics	https://archive.nptel.ac.in/courses/110/106/110106145/
Unit-IV	Organizational Change, Resistance to Change.	https://nptel.ac.in/courses/110105146

<table>
<tr><td>Course Code</td><td colspan="5">ECE-001B</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Digital Electronics</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To learn fundamentals of digital logic and Boolean algebra.
● To design combinational and sequential logic circuits.
● To understand ADC/DAC and memory devices.
● To study programmable logic devices like FPGA and CPLD.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated
CO1	Understand the knowledge of Boolean algebra, K-MAP and other digital design methods for simplification and optimization of digital circuits.
CO2	Design and implement combinational logic circuits using logic gates for arithmetic operations, code conversion, and control applications.
CO3	Understand and apply the concepts of latches, flip-flops, and counters in designing synchronous and asynchronous circuits for memory and storage applications.
CO4	Analyze memory types and programmable logic device architectures to interpret the functional organization.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Logic Simplification: Logic Simplification: Review of Boolean Algebra and De Morgan's Theorem, Digital codes, Logic gates and their operations, Realization of logic gates using universal gates, Number system, Representation of Boolean functions in sum of products (SOP) form and product of sums (POS), Addition and subtractions of a complements numbers, Minimization of Boolean functions using Karnaugh map and Quine McCuskeymethods, Error detection and correction techniques using Parity Check method and Hamming Code.

Unit-II

Combinational Logic Design: Half and Full Adders, Half and Full Subtractors, Multiplexers, Demultiplexers, Encoder, Decoder, Magnitude Comparators, Priority encoder, Parallel Adders, Adder with Look Ahead Carry, BCD Adder.

Unit-III

Sequential Logic Design: Latches, Concept of edge triggered and level triggered clock, S-R, JK and Master-Slave JK FF, D FF, T FF,Conversions of FF, Ripple and Synchronous counters, Ring and Johnson counter, UP & DOWN counter, Sequence Generator, Shift registers.

Unit-IV

A/D and D/A Converter: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel - comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.
Programmable Logic Devices: ROM, PLA, PAL, SRAM, DRAM, FPGA and CPLDs.

Suggested Readings:

1. Modern digital Electronics by R.P. Jain,Tata McGraw Hill, 4th edition.
2. Switching Theory & Logic Design by A.Anand Kumar, PHI.
3. Digital Electronics Circuit and System by V K Puri, TMH.
4. Digital Circuits and Systems by D.V. Hall, Tata McGraw Hill.
5. Principle of Digital Electronics by K Meena, PHI
6. Logic & Computer Fundamentals by Morris Mano,4th Edition, Pearson Education.

Useful Video links

Unit No.	Topics	Links
Unit-I	Boolean Algebra	https://www.youtube.com/shorts/xtAYbY_Pz7I
Unit-II	Multiplexer	https://www.youtube.com/watch?v=p6yPvw88BJk
	Combinational Circuits	https://www.youtube.com/watch?v=fXrbYMDevDU
Unit-III	Sequential Circuits	https://www.youtube.com/watch?v=S0mKCNLmCh4&list=PLgwJf8NK-2e4mEQv0ttgW-am4wiqrpdcX
	Counter	https://www.youtube.com/watch?v=NTCrCYPoA5A&list=PLgwJf8NK-2e6lcDg0NxW-_yO6Bl5dPBp8
Unit-IV	Finite state machines	https://www.youtube.com/watch?v=LOZxYBOKRLg
	PLD's	https://www.youtube.com/watch?v=m6975d-U6j8

Course Code	**CSE-L201B**				
Category	Professional Core Courses				
Course Title	**Data Structures Lab Using C**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To introduce C programming constructs for implementing data structures. ● To provide practical experience with linear data structures. ● To familiarize students with non-linear data structures and algorithms. ● To develop problem-solving skills using data structure implementations.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Understand the basics of C language and Turbo C Integrated Development Environment (IDE).	Level 2: Understand
CO2	Apply C programming to implement data arrays, pointers, data structures, searching, sorting, and basic data structure operations like stacks and linked lists.	Level 3: Apply
CO3	Apply C programming techniques to implement and manipulate non-linear data structures such as trees and hash tables.	Level 3: Apply
CO4	Analyze the applicability of appropriate data structures, control statements, iteration statements to implement searching and sorting.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Study the basics of Turbo C IDE.	CO1
2	Write a Program in C programming language to insert and delete an Element in Linear Array.	CO2
3	Write a Program in C programming language to Implement Array Traversing.	CO2
4	Write a Program in C programming language to Implement Linear Search.	CO2
5	Write a Program in C programming language to Demonstrate Binary Search.	CO2
6	Write a Program in C programming language to Insert and Delete Nodes into Linked List.	CO2

7	Write a Program in C programming language to Implement PUSH and POP in Stack.	CO2
8	Write a Program in C programming language to Implement Insertion Sort.	CO4
9	Write a Program in C programming language to Implement Bubble Sort.	CO4
10	Write a Program in C programming language to Implement Merge Sort.	CO4
11	Write a Program in C programming language to Implement Quick Sort.	CO4
12	Write a Program in C programming language to Implement Heap Sort.	CO4
13	Write a program in C programming language to implement a binary tree and perform its inorder, preorder, and postorder traversals.	CO3
14	Write a Program in C programming language to Find the Height of a Binary Tree in C.	CO3
15	Write a Program in C programming language to implement a hash table with separate chaining for collision resolution.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	Virtual Lab Link
Write a Program in C to implement Linear Search and binary Search.	https://ds1-iiith.vlabs.ac.in/exp/unsorted-arrays/code-assessment.html
Write a Program in C programming language to Implement Bubble Sort.	https://ds1-iiith.vlabs.ac.in/exp/bubble-sort/code-assessment.html
Write a Program in C to implement Merge Sort.	https://ds1-iiith.vlabs.ac.in/exp/merge-sort/code-assessment.html
Write a Program in C programming language to Implement Quick Sort.	https://ds1-iiith.vlabs.ac.in/exp/quick-sort/code-assessment.html
Write a program in C programming language to implement a binary tree and perform its inorder, preorder, and postorder traversals.	https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/code-assessment.html
Write a Program in C to implement Linear Search and binary Search.	https://ds1-iiith.vlabs.ac.in/exp/unsorted-arrays/code-assessment.html

Course code	**CSE-L203B**				
Category	Professional Core Courses				
Course title	**Operating Systems Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To introduce operating system utilities and shell programming concepts. ● To provide practical experience with Linux and UNIX environments. ● To familiarize students with operating system algorithms and resource management techniques. ● To develop problem-solving skills using shell scripting.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Describe the basic concepts and features of Linux, Windows, UNIX Operating System, basic UNIX commands and vi editor usage.	Level 2: Understand
CO2	Write shell scripts for system tasks like displaying user info, performing calculations, and managing files.	Level 3: Apply
CO3	Implement control structures in shell scripting to solve problems such as checking conditions and generating series.	Level 3: Apply
CO4	Analyze file allocation methods and CPU scheduling algorithms for efficient file and process management.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Explore the architecture, features, and file system of the Windows Operating System.	CO1
2	Explore the architecture, features, and file system of the Linux Operating System.	CO1
3	Study various UNIX Commands.	CO1
4	Understand the working of the VI editor and describe its modes, commands, and common file editing operations in UNIX/Linux.	CO1
5	Write a program to print the VI editor file data.	CO2
6	Write a shell program to implement a calculator.	CO2
7	Write a shell script to see current date, time, username and directory.	CO2

8	Write a program to check whether a number is odd or even using Shell Programming.	CO3
9	Write a program to find out the factorial of a number.	CO3
10	Write a program to generate Fibonacci Series.	CO3
11	Write a program to find the greatest number out of the seven numbers using a for loop.	CO3
12	Write a program to implement Do-While Loop.	CO3
13	Write a program to Implement any file allocation technique (Linked, Indexed or Contiguous)	CO4
14	Write a program to Implement any CPU scheduling technique (FCFS, SJF, SRJF, Priority and Round -Robin)	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Course code	**CSE-L205B**				
Category	Professional Core Courses				
Course title	**Python Programming Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To introduce Python programming fundamentals and development tools. ● To provide practical experience with Python programming techniques. ● To familiarize students with Python libraries for data processing and analysis. ● To develop skills for graphical, image-processing, and GUI-based applications.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Understand the installation process, basic features and programming constructs in Python.	Level 2: Understand
CO2	Apply Python programming techniques to implement algorithms for mathematical operations, searching, sorting and other real life problems.	Level 3: Apply
CO3	Apply NumPy and Pandas for data manipulation, statistical operations.	Level 3: Apply
CO4	Analyze Python's graphics, image processing, and GUI programming concepts to develop interactive applications.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Study the basic features and installation of Python.	CO1
2	Write a Python program to compute the G.C.D. of two numbers.	CO1
3	Write a Python program to find the square root of a number.	CO1
4	Write a Python program to find the power of a number.	CO1
5	Write a Python program to find the maximum in a list of numbers.	CO2
6	Write a Python program to implement linear search and binary search in a list.	CO2
7	Write a Python program to sort the element using selection sort, insertion sort and merge sort.	CO2

8	Write a Python program to compute first “n” prime numbers.	CO2
9	Write a Python program to find the most frequent word in a text file.	CO2
10	Write a Python program to create and perform operations on arrays using NumPy.	CO3
11	Write a Python program to apply Pandas for manipulating a dataset and performing grouped statistical operations.	CO3
12	Write a Program in Python for a random walk using turtle.	CO4
13	Create simple graphics using Turtle: draw shapes and take random walks.	CO4
14	Perform image processing: copy, blur, and reduce images using PIL or OpenCV	CO4
15	Design a GUI application using Tkinter with input, output, and buttons.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Arithmetic Operations	https://python-iitk.vlabs.ac.in/exp/arithmetic-operations/
Built-in Functions	https://python-iitk.vlabs.ac.in/exp/built-in-functions/
Loops	https://python-iitk.vlabs.ac.in/exp/loops/
Strings	https://python-iitk.vlabs.ac.in/exp/strings/
File Handling	https://python-iitk.vlabs.ac.in/exp/file-operators/simulation.html

Course Code	**ECE-L001B**			
Category	Professional Core Courses			
Course Title	**Digital Electronics Lab**			
Scheme and Credits	T	P	**Credits**	**Semester- III**
	0	2	1	
Course Objectives	The objectives of this course are ● To learn the basics of digital electronics and use logic gates and ICs. ● To design and check different combinational and sequential logic circuits. ● To understand the working operation of adders, subtractors, multiplexers, flip-flops, and counters in digital systems. ● To learn to build and test ADC, DAC, and practical counters for various applications.			
Assessment	10 Marks			
End Semester Practical Examination	15 Marks			
Total	25 Marks			
Duration of Exam	03 Hours			

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Understand and apply operational principles of logic gates used in digital systems.
CO2	Analyze and verify the operation of sequential circuits used in digital systems
CO3	Verify the truth tables and behavior of combinational circuits with different states and inputs.
CO4	Perform and verify the operation of ADC and DAC circuits for digital system applications.

List of Experiments

Sr. No.	**Content**
1	To study the operation of logic gates and verify their truth tables.
2	To verify the operation of universal gates.
3	To design and verify the operation of Binary-to-Gray and Gray-to-Binary code converters.
4	To design Half Adder and Full Adder circuits using gates.
5	To design and verify the operation of Half Subtractor and Full Subtractor circuits.
6	To study and verify the operation of Multiplexer and De-Multiplexer circuits.
7	To study the operation of Encoder and Decoder circuits.
8	To design and verify the operation of BCD-to-Seven Segment Decoder circuits.

9	To analyze and verify the operation and characteristic behavior of S-R, J-K, T, and D flip-flops under different input conditions.
10	To design and verify the operation of Decade counter using JK flip flops.
11	To design and verify the operation of 4-bit SISO and SIPO shift registers.
12	To analyze and verify the operation and performance characteristics of ADC and DAC circuits for digital system applications.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To study & design basic gates.	https://de-iitr.vlabs.ac.in/exp/truth-table-gates/
To study and realize logic functions with the help of universal gates.	https://de-iitr.vlabs.ac.in/exp/half-full-adder/
To verify the operation of Multiplexer & De-multiplexer.	https://de-iitr.vlabs.ac.in/exp/multiplexer-demultiplexer/
To perform half adder and full adder	https://de-iitr.vlabs.ac.in/exp/half-full-adder/
To perform half subtractor and full subtractor.	https://de-iitr.vlabs.ac.in/exp/half-full-subtractor/index.html
To verify the truth table of S-R, J-K, T& D Type flip flop.	https://de-iitr.vlabs.ac.in/exp/truth-tables-flip-flops/
To design & verify the operation of 3-bit synchronous counter.	https://de-iitr.vlabs.ac.in/exp/4bit-synchronous-asynchronous-counter/
To design & verify operation of Asynchronous counter.	https://de-iitr.vlabs.ac.in/exp/4bit-synchronous-asynchronous-counter/

<table>
<tr><td>Course Code</td><td colspan="5">MC-201B</td></tr>
<tr><td>Category</td><td colspan="5">Mandatory Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Environmental Science</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester- III</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>-</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
Create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources.
Develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health.
Foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society.
Engage students in practical learning through fieldwork and case studies to apply environmental concepts for sustainable development and responsible citizenship.</td></tr>
<tr><td>Practical/Field Visits</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
<tr><td>Remarks</td><td colspan="5">The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.
The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skill Demonstrated**	**Level**
CO1	Describe key concepts of environmental studies, types of natural resources, ecosystem structures, pollution types, major environmental laws, and human-environment interactions.	Level 1: Remember
CO2	Explain the interrelationships among ecosystems, biodiversity, pollution, social issues, environmental ethics, and related legislation for sustainable development.	Level 2 : Understand
CO3	Apply principles of environmental management, pollution control, disaster preparedness, and sustainable practices in real-world and field-based environmental contexts.	Level 3: Apply
CO4	Analyze environmental problems, population growth impacts, climate change, welfare programs, and the role of information technology in promoting public health and environmental sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

The Multidisciplinary nature of environmental studies. Definition scope and importance.

Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems.

a) Forest resources: Use and over-exploitation: deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer pesticide problems, Water logging, salinity, case studies. e) Energy resources: Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.

f) **Land resources:** Land as are source, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, equitable use of resources for sustainable life styles

Unit-II

Ecosystems: Producers, Consumers and Decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, Food web sand ecological pyramids**,** Introduction, types, characteristic features, structure and function of Forest ecosystem, Grass land ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Bio diversity and its conservation: Introduction, Definition, Genetic, Species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wild life, man-wild life conflicts, Endangered and endemic species of India, In-situ and ex-situ conservation of biodiversity.

Unit-III

Environmental Pollution: Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards.

Solids Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies.

Disaster Management: Floods, Earthquake, Cyclone and Landslides.

Social issues and the Environment: From unsustainable to sustainable development, Urban problems related to energy, Water conservation, Rain Water Harvesting, Watershed Management, Resettlement and Rehabilitation of People, its problems and concerns case studies.

Environmental Ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Waste land reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wild life Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Unit-IV

Human population and the Environment: Population growth, Variation among Nations, Population explosion-Family Welfare Programme, Environment and human health, Human Rights. Value Education, HIV/AIDS, Woman and Child Welfare Role of Information Technology in Environment and human health. Case Studies.

Field Work (Field work equal to10 lecture hours)- Visit to a local area to document environmental assets-

river/forest/grassland/hill/mountain, Visit to a local polluted site-urban/Rural/Industrial/ Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hills, slopes, etc.

Suggested Readings:

1. Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner
2. The Biodiversity of India by Bharucha, MA Pin Publishing Pvt. Ltd., Ahmedabad.
3. Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc., 1989
4. Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
5. Global Biodiversity Assessment by V.H. Heywood & R.T. Watson, Cambridge University Press, 1995, 1140p.
6. Environmental Protection and Laws by H. Jadhav& V.M. Bhosale, Himalaya Pub. House, Delhi, 1995, 284p.
7. Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
8. Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd., 1987, 345p.
9. Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut, 2001.
10. Survey of the Environment, The Hindu.
11. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
12. Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
13. Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA, 1998, 499p.
14. A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
Unit-II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
Unit-III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

<table>
<tr><td>Course Code</td><td colspan="5">CSE-202B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Discrete Mathematics</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To introduce the concept of mathematical logic, concept of sets, relation and functions.
● To introduce the concept of algorithm and number theory.
● To understand the group theory and related examples.
● To apply discrete structures to areas such as algorithms, data structures, digital logic, and cryptography.</td></tr>
<tr><td>Course Prerequisite</td><td colspan="5">Mathematics up to 12thStandard and Engineering Mathematics-I &II</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define the basic terms used in discrete mathematics and structures.	Level 1: Remember
CO2	Understand the fundamental techniques, laws, logics, relations, graphs and trees.	Level 2: Understand
CO3	Solve mathematical problems based on the concept of set theory, relations, functions and basic counting techniques.	Level 3: Apply
CO4	Classify lattices, logarithms, functions, algebraic structures, graphs and trees.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Sets, Relation, Function and Propositional Logic: Operations and Laws of Sets, Cartesian Products, Representation of relations, Binary Relation, Equivalence Relation, Partial Ordering Relation, POSET, Hasse Diagram, Lattices and its types, Function, Bijective functions, Inverse and Composite Function, Finite and infinite Sets, Countable and Uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem, Propositions, Logical operations, Conditional Statements, Tautologies, Contradictions, Logical Equivalence.

Unit-II

Basic Counting Techniques and Recurrence Relation: Pigeon-hole principle, Permutation andCombination, the Division algorithm: Prime Numbers, The GCD: Euclidean Algorithm, The Fundamental Theorem of Arithmetic., Linear recurrence relation with constant coefficients, Homogenous Solutions, Particular Solutions, Total Solutions, Solving recurrence relation using generating functions.

Unit-III

Algebraic Structures: Definitions and examples of Algebraic Structures with one Binary Operation: Semi Groups, Monoids, Groups; Congruence Relation and Quotient Structures, Permutation Groups, Cyclic groups, Normal Subgroups, Definitions and examples of Algebraic Structures with two Binary Operation: Rings, Integral Domain, Fields; Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Unit-IV

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Multigraph and Weighted graph, Shortest path in Weighted graphs, Eulerian paths and circuits, Hamiltonian path and circuits, Planar Graphs, Euler's formula, Graph Colouring, Trees, Binary trees and its traversals, Trees Sorting, Spanning tree, Minimal Spanning tree.

Suggested Readings:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill.
2. Satinder Bal Gupta: A Text Book of Discrete Mathematics and Structures, University Science Press, Delhi.
3. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics: A Computer Oriented Approach, Tata McGraw – Hill.
4. J.P. Tremblay and R. Manohar, Discrete mathematical structures with applications to computer science, TMG Edition, Tata McGraw-Hill.
5. Discrete Mathematics, Babu Ram, Pearson Publication.
6. Discrete Mathematics, SemyourLipschutz and Marc Lipson, Schaum's outline.

Useful Video links

Unit No.	Topics	Links
Unit-I	Sets	https://youtu.be/s-hRgTgdVe4?si=oN4wGgPzbqYvh-pv
	Functions	https://youtu.be/ceiMP4otA28?si=00SmukP2_XlqgeKK
	Representation of relations	https://youtu.be/wGLTV8MgLlA?si=KQ3UQ6hnj8szYIvN
	Propositions Calculus	https://youtu.be/WQ40fJskFIE?si=jVpwPuZ8pUW78QWj
Unit-II	Permutation and Combination, the Division algorithm	https://youtu.be/BI84sbsOtGQ?si=ZTFN88-qrGlOwquH
	The GCD: Euclidean Algorithm	https://youtu.be/BI84sbsOtGQ?si=ZTFN88-qrGlOwquH
	Pigeon-hole principle	https://youtu.be/a-O-ioYy1rI?si=_bIKGfCet8sM8csj
	Linear recurrence relation	https://youtu.be/CsvJPEgzF18?si=lpJz5yj1X8cVuTui
	Total Solutions, Solving recurrence relation using generating functions	https://youtu.be/ZxqBgiW1VBw?si=8_5FRbpei6fKRDX1
Unit-III	Algebraic Structures: Definitions and examples of Algebraic Structures with one Binary Operation	https://youtu.be/3zOtLEeHygg?si=k9s9ejEkVLKRc1kI
	Groups; Congruence Relation and Quotient Structures	https://youtu.be/3zOtLEeHygg?si=k9s9ejEkVLKRc1kI
	Definitions and examples of Algebraic Structures with two Binary Operations	https://youtube.com/playlist?list=PLq76ktDFTJEKPnC7dWNEOYHytKvrQ4en0&si=B1K2ne130ijMGoU5
Unit-IV	Graphs and their properties	https://youtu.be/3zOtLEeHygg?si=oXeg4i1GEzZ640wx
	Eulerian paths and circuits, Hamiltonian path	https://youtu.be/3zOtLEeHygg?si=oXeg4i1GEzZ640wx
	Trees, Binary trees and its traversals	https://youtu.be/3zOtLEeHygg?si=oXeg4i1GEzZ640wx
	Trees Sorting, Spanning tree, Minimal Spanning tree	https://youtu.be/3zOtLEeHygg?si=oXeg4i1GEzZ640wx

Course Code	**CSE-204B**				
Category	Professional Core Courses				
Course Title	**Computer Organization and Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals of computer organization and architecture. • To provide knowledge of processor organization and instruction execution. • To familiarize students with memory hierarchy and input-output systems. • To develop understanding of performance enhancement techniques in computer systems.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts and terminology of computer organization and architecture.	Level 1: Remember
CO2	Explain the principles and techniques used in computer organization and architecture.	Level 2: Understand
CO3	Apply computer organization concepts to processor, memory, and input-output systems.	Level 3: Apply
CO4	Analyze the performance and structure of computing systems for evaluation of CPU design choices, pipeline efficiency, memory access methods, and data transfer mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes,
Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Micro-operations, Arithmetic Logic Shift Unit.

Unit-II

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit: General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

Unit-III

Pipelining: Basic Concepts of Pipelining, Throughput and Speedup, Performance Metrics (CPI, MIPS, MFLOPS), Pipeline Hazards.
Parallel Processors: Introduction to Parallel Processors, Concurrent access to memory and cache coherency.

Unit-IV

Input-output Organization: I/O device interface, I/O Interface Standards - PCI, USB; I/O transfers - program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.
Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

Suggested Readings:

1. Computer System Architecture, M.Morris Mano, Pearson.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy, Elsevier.
3. Computer Organization and Embedded Systems, CarlHamacher, McGraw Hill Higher Education.
4. Computer Architecture and Organization, John P. Hayes, McGraw Hill Education.
5. Computer Organization and Architecture: Designing for Performance, William Stallings, Pearson Education.

Useful Video links

Unit No.	Topics	Links
Unit-I	Data Representation	https://youtu.be/Vc2KqHQKDNs
	Binary Codes	https://youtu.be/Y5yprWIPDps
	Shift Microoperations	https://youtu.be/U5aCveZ8VzE
Unit-II	Instruction Cycle	https://youtu.be/L2SLS9FgTx0
	Control Signals and Timing Sequence	https://youtu.be/LNLjGgsDjBk
	Hardwired controlled Control Unit	https://youtu.be/b5thcNYBrQc
Unit-III	Pipelining Introduction	https://youtu.be/3p8kZpT56lQ
	Pipeline Hazards	https://youtu.be/l7auULi7zls?list=PLbMVogVj5nJQmNqgs7GLBE-HhMi0GQOPW
	Cache coherence and memory consistency	https://youtu.be/QfZa8gKzFJA
Unit-IV	DMA Transfer	https://youtu.be/CSkN0wj0zZU
	Memory Hierarchy	https://youtu.be/X-XwOXdUPU4
	Cache Memory	https://youtu.be/XZF4khqXmNI

Course Code	**CSE-206B**				
Category	Professional Core Courses				
Course Title	**Object Oriented Programming**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce object-oriented programming concepts and principles. ● To provide knowledge of classes, objects, inheritance, and polymorphism. ● To familiarize students with memory management and exception handling techniques. ● To develop software development skills using object-oriented programming.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts and terminology of object-oriented programming.	Level 1: Remember
CO2	Explain the principles and techniques used in object-oriented programming.	Level 2: Understand
CO3	Apply object-oriented programming concepts to develop software solutions.	Level 3: Apply
CO4	Analyze object-oriented programming approaches for software development.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.
Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

Unit-II

Inheritance: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors.
Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through

pointers, pointer arithmetic, pointers to objects, array of objects, pointers to object members, memory allocation (static and dynamic), dynamic memory management using new and delete operators, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

Unit-III

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists.
Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.
Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.

Unit-IV

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, re-throwing an exception, specifying exceptions.
Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples. Introduction to STL, Inheritance of class template, class template containership, class template with overloaded operators.

Suggested Readings:

1. C++ Programming language by Bjrane Stroustrup,3rd edition, Pearson education Asia(1997).
2. Object oriented Programming in C++ by LaforeR.,4th Ed. Techmedia,New Delhi(2002).
3. Let us C++ by Yashwant Kenetkar,1stEd.,Oxford University Press(2006).
4. A structured approach using C++ by B.A. Forouzan and R.F. Gilberg, Cengage Learning, New Delhi.

Useful Video links

Unit No.	Topics	Links
Unit-I	Introduction to Object-Oriented Programming.	https://youtu.be/K3g4srbkUNM?feature=shared
	Classes and Objects in C++	https://youtu.be/Fvb0dPTm3fk?feature=shared
	Introduction to Paradigms of OOP	https://youtu.be/d62teoIJtOw?feature=shared
Unit-II	Inheritance - Single Inheritance	https://youtu.be/gzCOAmbR9cc?feature=shared
	Multilevel Inheritance	https://youtu.be/PaqAhlb5XVw?feature=shared
	Polymorphism	https://youtu.be/piK6my-0frA?feature=shared
Unit-III	Constructors in C++	https://youtu.be/ItkQswAvOLI?feature=shared
	Access Specifiers in C++	https://youtu.be/xKtO4yipsIY?feature=shared
	Overloading-Operator and Constructor	https://youtu.be/WUiKCKc-3v0?feature=shared
Unit-IV	Exception Handling in C++	https://youtu.be/nGFzkmUvO_I?feature=shared
	Template Class in C++	https://youtu.be/jNmyE17nRYo?feature=shared

Course Code	**CSE-208B**				
Category	Professional Core Courses				
Course Title	**Database Management System**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To introduce basic concepts, architecture, and characteristics of database systems. • To understand relational algebra and SQL for querying and manipulating relational data. • To understand storage strategies, indexing methods, and transaction processing mechanisms. • To explore database security models and advanced database systems like distributed and object-oriented databases.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, terminology, and components of database management systems.	Level 1: Remember
CO2	Explain the principles, models, techniques, and mechanisms used in database management systems.	Level 2: Understand
CO3	Apply database management techniques for database design, query formulation, transaction processing, and data management.	Level 3: Apply
CO4	Analyze database models, processing strategies, concurrency mechanisms, and security techniques for efficient data management.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).
Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit-II

Relational query languages: Relational algebra, Tuple and domain relational calculus,SQL3, DDL and DML constructs, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-

queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types, Procedures, Triggers.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Unit-III

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.
Storage strategies: Indices, B-trees, hashing, single level indexes, Multi-level indexes.

Unit-IV

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.
Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Suggested Readings:

1. Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw-Hill.
2. Principles of Database and Knowledgebase Systems by J. D. Ullman, Vol 1, Computer Science Press.
3. Fundamentals of Database Systems by R. Elmasri and S. Navathe, 5th Edition, Pearson Education.
4. Foundations of Databases by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley.

Useful Video links

Unit No.	Topics	Links
Unit-I	Introduction to DBMS	https://youtu.be/rbwXdTsCk2c?si=hHLikD9WqWu9cZxm
	Conceptual Modelling (E-R Model)	https://youtu.be/rbwXdTsCk2c?si=hHLikD9WqWu9cZxm
Unit-II	SQL Query-I	https://youtu.be/k-KHHN7nDI8?si=ArzMxaPeBIhlySt4
	SQL Query-II	https://youtu.be/cGQaaVlbcCQ?si=qmJxp5sUFmaoqYlx
	Integrity Constraint	https://youtu.be/8lRc-Pt_krk?si=87NfB7a3OBCtmuWg
	Functional Dependency	https://youtu.be/rbwXdTsCk2c?si=hHLikD9WqWu9cZxm
Unit-III	Storage and file structure	https://youtu.be/1IWtpmIniHQ?si=DdBI9TrgAgOXBn8K
	Indexing and Hashing	https://youtu.be/rbwXdTsCk2c?si=hHLikD9WqWu9cZxm
Unit-IV	Concurrency Control	https://youtu.be/rbwXdTsCk2c?si=hHLikD9WqWu9cZxm
	DAC - MAC and RBAC security models	https://www.youtube.com/watch?v=n8anyniHbvI

<table>
<tr><td>Course Code</td><td colspan="5">CSE-210B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Artificial Intelligence</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To introduce the fundamental concepts, history, and problem-solving nature of artificial intelligence.
● To provide an understanding of core AI techniques for search, knowledge representation, reasoning, planning, and learning.
● To develop the ability to apply appropriate AI methods to solve representative computational problems.
● To familiarize students with modern AI systems, expert systems, neural networks, and emerging trends in artificial intelligence.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define fundamental concepts of artificial intelligence, problem characteristics, knowledge representation, learning paradigms, and current AI trends.	Level 1: Remember
CO2	Explain search strategies, knowledge representation schemes, reasoning under uncertainty, planning approaches, and learning methods used in artificial intelligence.	Level 2: Understand
CO3	Apply appropriate AI techniques such as search algorithms, logical reasoning, probabilistic methods, and learning models to solve representative AI problems.	Level 3: Apply
CO4	Analyze AI problems to select suitable problem-solving, reasoning, planning, or learning approaches and evaluate their effectiveness.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Definition of AI, History of AI, nature of AI problems, examples of AI problems.
Problem solving by search: Uninformed Search: Depth First Search (DFS), Breadth First Search(BFS). Informed Search: Best First Search, A*. Local Search: Hill Climbing. Problem Reduction Search: AO*. Population Based Search: Ant Colony Optimization, Genetic Algorithm. Game Playing: MinMax Algorithm, Alpha-Beta Pruning.

Unit-II

Knowledge Representation: Types of Knowledge, Knowledge Representation Techniques/schemes: Propositional Logic, Predicate Logic, Semantic nets, Frames, Knowledge representation issues, Rule based systems.

Unit-III

Reasoning under Uncertainty: Basics of Probability Theory, Probabilistic Reasoning, Bayesian Reasoning, Dempster-Shafer Theory.
Planning: Introduction to Planning, Representation of Planning, Partial-order Planning.

Unit-IV

Learning: Introduction to Learning, Types of Learning: Learning by Induction, Rote Learning, Symbol Based Learning, Identification Trees, Explanation Based Learning, Transformational Analogy, Introduction to Neural Networks, Expert Systems, and Current trends in Artificial Intelligence.

Suggested Readings:

1. Artificial Intelligence: A Modern Approach, Third Edition by Stuart Russell and Peter Norvig, 2010, Pearson Education.
2. Elaine Rich, Kevin Knight, &Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009.
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010.
4. Artificial intelligence, Patrick Henry Winston, 1992, Addition Wesley.

Useful Video links

Unit No.	Topics	Links
Unit-I	Introduction to AI	https://youtu.be/iF1tOCEXLXY
	DFS, BFS	https://youtu.be/TMLyKcBtHuo
	Hill Climbing	https://youtu.be/ZOvRZ7UJMjk
	A* Algorithm	https://youtu.be/yMcZvZayJUA
Unit-II	Propositional Logic	https://youtu.be/5fZ_RnhvGMQ
	Semantic Nets	https://youtu.be/RTmafl2rzEw
	Rule based System	https://youtu.be/6kRYg1QVcWo
Unit-III	Bayesian Reasoning	https://youtu.be/cMN6ykIYF_U
	Probability Theory	https://nptel.ac.in/courses/117105085
	Partial-order Planning	https://www.youtube.com/watch?v=kyCibTQQQBE
Unit-IV	Introduction to Neural Networks	https://www.youtube.com/watch?v=QlhHqMnd9Wo
	Expert Systems	https://www.youtube.com/watch?v=nE5c5w4aizU

<table>
<tr><td>Course Code</td><td colspan="5">HSMC-02B</td></tr>
<tr><td>Category</td><td colspan="5">Humanities and Social Science including Management Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Economics for Engineers</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III/IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are to
● Introduce the basic concepts of economics and their relevance to science, engineering, and national development.
● Develop a foundational understanding of microeconomic principles such as demand, supply, production, cost, and market structures.
● Equip students with tools to apply economic reasoning to real-world pricing, output, and market decisions.
● Familiarize students with macroeconomic elements like the Indian economy, banking system, privatization, and globalization.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe economic concepts, the connection between economics with engineering and technological development, along with economic laws relevant to resource based decision making in society.	Level 1: Remember
CO2	Explain economic growth theories and illustrate the role of engineering and technology in supporting economic development.	Level 2: Understand
CO3	Apply theories of consumption and production to the design and development of engineering products.	Level 3: Apply
CO4	Analyze market conditions, evaluate cost structures and financial aspects to assess the feasibility of engineering projects.	Level 4: Analyse

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Definition of Economics: Various Definitions, Types of Economics, Micro and Macro Economics, Nature of Economic Problem, Production Possibility Curve, Economic Laws and their Nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand: Meaning of Demand, Law of Demand, Elasticity of Demand, Meaning, Factors affecting the Elasticity of Demand, Practical Application and Importance.

Unit-II

Production: Meaning of Production and Factors of production, Law of Variable Proportions, Returns to Scale, Internal and External Economies and Diseconomies of Scale, Various concepts of Cost of Production- Fixed Cost, Variable Cost, Money Cost, Real Cost, Accounting Cost, Marginal Cost, Opportunity Cost, Shape of Average Cost, Marginal Cost, Total Cost etc. in short run and long run.

Unit-III

Market: Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).
Supply: Supply and Law of Supply, Role of Demand and Supply in Price Determination and Effect of Changes in Demand and Supply on Prices.

Unit-IV

Indian Economy: Nature and Characteristics of Indian Economy as underdeveloped, developing and mixed economy (brief and elementary introduction).
Privatization: Meaning, Merits and Demerits.
Globalization of the Indian Economy: Merits and Demerits
Banking: Concept of a Bank, Commercial Bank, Central Bank, Functions of a Bank, Difference between Commercial and Central Bank.

Suggested Readings:

1. Modern Microeconomics: Theory and Applications by H.L. Ahuja, S. Chand & Company Pvt. Ltd.
2. Indian Economy by S.K. Misra& V.K. Puri, Himalaya Publishing House
3. Indian Economy : Principles and Policies by Srirangam, SriRam, ; RohitDeo, Pearson Education
4. Managerial Economics by R. Cauvery et al., S. Chand & Company Pvt. Ltd.
5. Microeconomic Theory by Andreu; Whinston, Michael D; Green, Jerry R, Oxford University Press.
6. Principles of Economics by Case, Karl E; Fair, Ray C ; Oster, Sharon E, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Fundamental concepts of microeconomics, including definitions, types, and the nature of economic problems.	https://www.youtube.com/watch?v=IFtOcNbej0o&list=PLFNFJbo2hfBGRTCMuroZGykNzacwmAH2L
Unit-II	Production and Cost of production	https://www.youtube.com/watch?v=VU1zySe-8NA
Unit-III	Theory of Markets	https://www.youtube.com/watch?v=HylqSa58lqQ
Unit-IV	Nature and characteristics of the Indian economy, highlighting aspects of underdevelopment and development.	https://www.youtube.com/watch?v=ME-0GOhhZcs&list=PLFW6lRTa1g83winAoIK92HL4xTytJaW7S

Course Code	**CSE-L206B**				
Category	Professional Core Courses				
Course Title	**Object Oriented Programming Lab Using C++**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To enable students to develop C++ programs using classes, member functions, and constructors to apply object-oriented principles to real-world problems. ● To implement static members, constant members, and various constructors in C++ for designing efficient and robust class structures. ● To apply operator overloading, inheritance, polymorphism, and exception handling techniques for building maintainable and flexible C++ applications. ● To create and utilize templates and manage dynamic memory allocation and deallocation in C++ for efficient program development.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Understand object-oriented concepts for programming in C++.	Level 2: Understand
CO2	Implement classes, member functions, and constructors in C++ to solve real-world problems using object-oriented principles.	Level 3: Apply
CO3	Demonstrate the use of operator overloading, inheritance, polymorphism, and exception handling in C++ to create robust and maintainable code.	Level 3: Apply
CO4	Analyze advanced OOP features in C++ programming language for better programs.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**	**COs**
1	Study Object Oriented Programming Concepts in C++.	CO1
2	Write a program that uses a class where the member functions are defined inside a class.	CO1
3	Write a program that uses a class where the member functions are defined outside a class.	CO1
4	Write a program to demonstrate the use of static data members.	CO1
5	Write a program to demonstrate the use of const data members.	CO1

6	Write a program to demonstrate the use of zero argument and parameterized constructors.	CO2
7	Write a program to demonstrate the use of dynamic constructor	CO4
8	Write a program to demonstrate the use of explicit constructors.	CO2
9	Write a program to demonstrate the use of initializer list.	CO2
10	Write a program to demonstrate the overloading of increment and decrement operators.	CO2
11	Write a program to demonstrate the overloading of binary arithmetic operators.	CO2
12	Write a program to demonstrate the overloading of memory management operators.	CO4
13	Write a program to demonstrate the multilevel inheritance.	CO3
14	Write a program to demonstrate the virtual derivation of a class.	CO3
15	Write a program to demonstrate the runtime polymorphism.	CO4
16	Write a program to demonstrate the exception handling.	CO4
17	Write a program to demonstrate the use of function templates.	CO4
18	Write a program to demonstrate the use of class templates.	CO4
19	Write a program to find the mean of two numbers of different classes using the Friend function.	CO3
20	Write a program to swap two numbers of the same class using the Friend function.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Write a program that uses a class where the member functions are defined inside a class.	https://www.youtube.com/watch?v=c9vSNQtQVaA&list=PLduM7bkxBdOekXfkEqIBAivzG99V2LrAS&index=3
Write a program to demonstrate the use of zero argument and parameterized constructors	https://www.youtube.com/watch?v=gL7GBhvbvIo&list=PLduM7bkxBdOekXfkEqIBAivzG99V2LrAS&index=7
Write a program to demonstrate the use of const data members	https://www.youtube.com/watch?v=8HQHZVLbVUg&list=PLduM7bkxBdOekXfkEqIBAivzG99V2LrAS&index=17
Write a program to demonstrate the overloading of increment and decrement operators.	https://www.youtube.com/watch?v=Lvl6xi0JAkA&list=PLduM7bkxBdOekXfkEqIBAivzG99V2LrAS&index=24

Course Code	**CSE-L208B**				
Category	Professional Core Courses				
Course Title	**Database Management System Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To introduce basic concepts, architecture and characteristics of database system ● To introduce relational model concepts and PL/SQL programming ● To introduce relational database design and Normal forms based on functional dependencies.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Explain the basics of SQL, PL/SQL Block and Procedures.	Level 2: Understand
CO2	Write the SQL Queries, PL/SQL Block to satisfy some conditions and exception.	Level 3: Apply
CO3	Apply the concepts of relationships in relational databases.	Level 3: Apply
CO4	Analyze the use of views, sequences, indexes, constraints, and relationships to ensure data integrity and performance.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**	**COs**
1	Study the basic features, syntax and components of SQL.	CO1
2	Create a database and write SQL queries to retrieve information from the database.	CO2
3	Perform Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.	CO2
4	Use Aggregate Functions- COUNT, SUM, AVG, MIN, MAX with GROUP BY and HAVING Clause.	CO2
5	Create Views, Synonyms, Sequence, Indexes, Save point.	CO4
6	Create an Employee database to set various constraints.	CO4
7	Create relationships between the databases.	CO4
8	Study the PL/SQL blocks.	CO1
9	Write a PL/SQL block to satisfy some conditions by accepting input from the user.	CO3

10	Write a PL/SQL block that handles all types of exceptions.	CO3
11	Create Procedures.	CO3
12	Create and implement database triggers and functions.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab links

Experiment Name	**Link**
Using Aggregate Functions-COUNT, SUM, AVG, MIN, MAX with GROUP BY and HAVING Clause	https://youtu.be/muwEdPsx534?si=6Ys2whV9ekMGng93
Creation of Views, Synonyms, Sequence, Indexes, Save point.	https://www.youtube.com/watch?v=tdRihGrzOg4
PL/SQL block code that handles all types of exceptions.	https://www.youtube.com/watch?v=0fzTqyk3dmQ
Creation of database triggers and functions	https://www.youtube.com/watch?v=hTRr-tVVfZ4

<table>
<tr><td>Course code</td><td colspan="5">CSE-L210B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Artificial Intelligence Lab using Python</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To introduce the foundational concepts of Artificial Intelligence and familiarize students with classical AI techniques for problem solving.
● To equip students with the ability to model real-world problems using AI representations such as state-space, search trees, and logic-based systems.
● To provide hands-on experience in implementing AI algorithms using Python for solving puzzles, games, and optimization problems.</td></tr>
<tr><td>Assessment</td><td colspan="5">10 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">15 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">25 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated	RBT Level
CO1	Understand the fundamental concepts and working principles of classical AI search algorithms such as BFS, DFS.	Level 2: Understand
CO2	Apply search algorithms to solve standard AI problems such as Tic-Tac-Toe, and Water Jug problem using Python.	Level 3: Apply
CO3	Implement heuristic-based and problem-specific algorithms like A and AO* for solving real-world path finding and decision problems.	Level 3: Apply
CO4	Analyze various AI techniques in context to their suitability for solving complex problems such as Monkey-Banana, Missionaries-Cannibals, and 8-Queens.	Level 4: Analyze

List of Experiments

Sr. No.	Contents	COs
1	Study and explain the logic and flow of BFS and DFS search algorithms.	CO1
2	Write a Program to implement Breadth First Search using Python.	CO1, CO2
3	Write a Program to implement Depth First Search using Python.	CO1, CO2
4	Write a Program to implement A* algorithm using Python.	CO3
5	Write a Program to implement AO* algorithm using Python.	CO3
6	Write a Program to implement Tic-Tac-Toe game using Python.	CO2

7	Write a Program to implement 8-Puzzle problem using Python.	CO3
8	Write a Program to implement Water-Jug problem using Python.	CO2
9	Write a Program to implement Travelling Salesman Problem using Python.	CO3
10	Write a Program to implement Tower of Hanoi using Python.	CO2
11	Write a Program to implement Monkey Banana Problem using Python.	CO4
12	Write a Program to implement Missionaries-Cannibals Problems using Python.	CO4
13	Write a Program to implement 8-Queens Problem using Python.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Course Code	**CSE-212B**				
Category	Professional Elective Courses				
Course Title	**Cloud Computing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the fundamental concepts, characteristics, and service models of cloud computing. ● To explain key cloud technologies such as virtualization, web services (SOAP and REST), and cloud platforms. ● To develop skills in managing cloud data systems. ● To analyze cloud security principles, quality of service (QoS) issues, and intercloud challenges, preparing students to design secure and efficient cloud solutions.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts and terminology of cloud computing.	Level 1: Remember
CO2	Explain the principles, architectures, and technologies of cloud computing.	Level 2: Understand
CO3	Apply cloud computing concepts, technologies and tools, to deploy and manage cloud-based applications and services effectively.	Level 3: Apply
CO4	Analyze cloud computing solutions with respect to performance, security, and reliability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Comparison among SAAS, PAAS, IAAS, Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure.

Unit-II

Introduction to Cloud Technologies, Study of Hypervisors, SOAP, REST, Comparison of SOAP and REST, Web services, mashups-Web services, Mashups: user interface services, Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores.

Unit-III

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo, Map-Reduce and extensions: Parallel computing, The map-Reduce model. MICEF Computing (Mist, IOT, Cloud, Edge and FOG Computing): Concept and Application.

Unit-IV

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture, Issues in cloud computing, Issues in Intercloud environments, QoS Issues in Cloud, Streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment, Inter Cloud issues, load balancing, resource optimization.

Suggested Readings:

1. Cloud Computing Bible by Sosinsky Barrie, Wiley India, 2011.
2. Cloud computing: Principles and paradigms by Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds., Vol. 87, John Wiley & Sons, 2010.
3. Cloud Computing Black Book by Jayaswal, Kailash, John Wiley & Sons, 2014.
4. Cloud Computing: A Practical Approach by Velte, Anthony T., Toby J. Velte, and Robert Elsenpeter, McGraw-Hill, Inc. 2019.
5. Cloud Computing : A Complete Guide by Gerardus Blokdyk, Starcooks, 2019.

Useful Video links

Unit No.	Topics	Links
Unit-I	Cloud Computing	https://youtu.be/NzZXz3fJf6o?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
	SAAS, PAAS, IAAS	https://youtu.be/lOh2x-UACaU?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
Unit-II	Cloud Computing Web Services	https://youtu.be/GtJGB1WxRW8?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
Unit-III	Cloud file system, GFS	https://youtu.be/Dr6MSqRFaZQ?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
	Map reduce	https://youtu.be/XWNEhv-b2PM?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
Unit-IV	Cloud Security	https://youtu.be/LcAPj95KeSA?list=PL-FqPEn1dZJDg-6LHNYnappA6DcXz3ieZ

<table>
<tr><td>Course Code</td><td colspan="5">CSE-214B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Nature Inspired Computing Techniques</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To introduce the fundamental concepts and biological motivations behind nature-inspired computing.
● To explore various algorithms derived from evolutionary, swarm-based, immune, and DNA models.
● To develop the ability to apply nature-inspired techniques to solve real-world computational problems.
● To cultivate analytical skills for evaluating the behavior and effectiveness of bio-inspired algorithms.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated	RBT Level
CO1	Define key concepts and terminology of nature-inspired computing techniques.	Level 1: Remember
CO2	Explain the working principles of biologically inspired algorithms and models.	Level 2: Understand
CO3	Apply nature-inspired algorithms to computational and optimization problems.	Level 3: Apply
CO4	Analyze the performance and behavior of nature-inspired approaches in varied scenarios.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction, Overview of Philosophy, Nature to Nature Computing, A Brief Overview of Three Branches, Individuals, Entities and agents, Parallelism and Distributivity Interactivity, Adaptation- Feedback, SelfOrganization, Complexity, Emergence, Bottom-up Vs Top-Down Approach, Determination, Chaos and Fractals.

Unit-II

Evolutionary Computing, Hill Climbing, Simulated Annealing, Genetics Principles, Standard Evolutionary Algorithm, Genetic Algorithms, Reproduction, Crossover Mutation, Evolutionary Programming, Genetic Programming.

Unit-III

Swarm Intelligence – Introduction, Ant Colony Optimization, Ant Foraging Behavior, Ant Colony Optimization, SACO algorithm, Ant Colony Algorithm (ACA), Scope of ACO algorithms, Swarm Robotics, Social Adaptation of Knowledge, Particle Swarm Optimization. Immune System-Introduction to Immune System, Physiology and main components, Pattern Recognition and Binding, Immune Network Theory, Danger Theory, Immune Algorithms, Genetic algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks.

Unit-IV

DNA Computing, DNA Molecule, Adleman's experiment, PAM Model, Splicing Systems, From Classical to DNA Computing, Universal DNA Computers, Scope of DNA Computing, Lipton's Solution to SAT Problem, Recent Trends and real world applications.

Suggested Readings:

1. Fundamentals of Natural Computing, Basic Concepts, Algorithms And Applications by Leandro Nunesde Castro, Chapman & Hall/CRC, Taylor and Francis Group, 2007.
2. Bio- Inspired Artificial Intelligence: Theories, Methods and Technologies by Floreano D. and Mattiussi C., MIT Press, Cambridge, 2008.
3. Handbook of Nature-Inspired and Innovative Computing by Albert Y. Zomaya, Springer, 2006.
4. Ant Colony Optimization by Marco Dorrigo, Thomas Stutzle, PHI, 2005.

Useful Video links

Unit No.	Topics	Links
Unit-I	Nature to Nature Computing	https://youtu.be/LBGninIdu1k?feature=shared
	Chaos and Fractals	https://www.youtube.com/watch?v=INXuVxhJfc4
Unit-II	Hill Climbing	https://youtu.be/ZOvRZ7UJMjk
	Simulated Annealing	https://youtu.be/TC9WNwM2noM
	Genetic algorithms	https://www.youtube.com/watch?v=WueuYdDqUt0
	Evolutionary Programming	https://www.youtube.com/watch?v=Yma8Y-W0SYE
Unit-III	Ant Colony Optimization	https://www.youtube.com/watch?v=u7bQomllcJw
	Particle Swarm Optimization.	https://www.youtube.com/watch?v=HmDjfL3R39M
	Immune Network Theory	https://www.youtube.com/watch?v=b5LojEVC97M
	The Danger Theory	https://www.youtube.com/watch?v=urd4uWJ2rH4
Unit-IV	DNA Computing	https://www.youtube.com/watch?v=vefBhhjodpE
	Adleman's experiment	https://www.youtube.com/watch?v=C_f7ky0mBsk
	PAM Model	https://www.youtube.com/watch?v=c0751ITCi5g
	DNA Computing	https://www.youtube.com/watch?v=vefBhhjodpE

Course Code	**CSE-216B**				
Category	Professional Elective Courses				
Course Title	**Human Computer Interaction**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts of human-computer interaction. • To provide knowledge of interface design principles and interaction techniques. • To familiarize students with usability and evaluation methods. • To develop user-centered design skills.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define the fundamental concepts and terminology of human-computer interaction.	Level 1: Remember
CO2	Explain the principles and techniques used in human-computer interaction.	Level 2: Understand
CO3	Apply standard design rules, usability principles, and interface patterns to create user-friendly screen layouts and interactive interfaces.	Level 3: Apply
CO4	Analyze various evaluation techniques to assess and improve the usability of human-computer interfaces.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Definition and scope of HCI, Importance and applications of HCI, Importance of user Interface – definition, importance of good design, Benefits of good design, A brief history of Screen design, The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

Unit-II

Design process: Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions. Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Unit-III

Windows: New and Navigation schemes selection of window, selection of devices based and screen-based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colours, Voice-based interaction (Alexa, Siri, and Google Assistant), Augmented Reality (AR) and Virtual Reality (VR) interfaces.

Unit-IV

HCI in the software process: the software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction.

Suggested Readings

1. The essential guide to user interface design by Wilbert O Galitz, Wiley Dream Tech.
2. Human – Computer Interaction by Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Pearson Education
3. Designing the user interface by Ben Shneidermann, 3rd Edition, Pearson Education Asia.
4. Interaction Design Prece by Rogers, Sharps, Wiley Dreamtech.
5. User Interface Design by Soren Lauesen, Pearson Education.

Unit No.	Topics	Links
Unit-I	Definition and scope of HCI	https://www.youtube.com/watch?v=sAShrCXzgC8
	Graphical User Interface	https://youtu.be/aaGPJzO9FIk?feature=shared
Unit-II	Design process-Human interaction with computers	https://youtu.be/uFYuHHglC6U?feature=shared
	Screen Designing	https://www.youtube.com/watch?v=lpIBwp7txhY
Unit-III	Multimedia	https://www.youtube.com/watch?v=fAJzLuce_ms&t=106s
	Virtual Reality (VR) interfaces	https://youtu.be/aNC5YMUTcQ4?feature=shared
Unit-IV	Software life cycle	https://www.youtube.com/watch?v=c1QR6EapK4k
	Evaluation techniques	https://www.youtube.com/watch?v=PMr3wWfAH0c

<table>
<tr><td>Course Code</td><td colspan="5">CSE-218B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Fundamentals of Multimedia</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To introduce the fundamental concepts, components, and applications of multimedia systems.
● To provide knowledge of multimedia data representation and compression techniques.
● To familiarize students with audio, video, animation, and multimedia processing technologies.
● To develop understanding of multimedia networking, synchronization, and emerging multimedia applications.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated	RBT Level
CO1	Define the fundamental concepts, terminology, components, and technologies of multimedia systems.	Level 1: Remember
CO2	Explain the principles, techniques, and standards used in multimedia data processing and communication.	Level 2: Understand
CO3	Apply multimedia technologies, compression methods, and processing techniques in multimedia applications.	Level 3: Apply
CO4	Analyze multimedia systems, communication mechanisms, and application frameworks for diverse domains.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Multimedia: Introduction to Multimedia and its characteristics, Elements of Multimedia: Text, Graphics, Audio, Video, Animation, Multimedia hardware and software components, Multimedia data representation, Multimedia applications and challenges, Multimedia authoring tools.

Unit-II

Multimedia Data Compression: Need for compression, Lossless and Lossy compression techniques, Run Length Encoding (RLE), Huffman Coding, Lempel-Ziv-Welch (LZW) compression, JPEG image compression standards, MPEG video compression standards.

Unit-III

Audio and Video Processing: Digital audio concepts and formats, Audio compression techniques, MIDI and speech processing, Digital video fundamentals, Video formats and standards, Video compression and streaming techniques, Animation principles and techniques.

Unit-IV

Multimedia Networking and Applications: Multimedia communication systems, Quality of Service (QoS) requirements, Multimedia databases, Multimedia synchronization, Hypermedia and web-based multimedia, Virtual Reality and Augmented Reality concepts, Multimedia applications in education, entertainment, healthcare, and e-commerce.

Suggested Readings:

1. Multimedia Systems by Ralf Steinmetz and KlaraNahrstedt, Springer, 2004.
2. Fundamentals of Multimedia by Ze-Nian Li and Mark S. Drew, Springer Nature, 2014.
3. Multimedia: Making It Work by Tay Vaughan, McGraw-Hill Osborne Media, 2014.
4. Multimedia Communications by Fred Halsall, Addison Wesley, 2000.

Useful Video links

Unit No.	Topics	Links
Unit-I	Introduction to Multimedia and its characteristics	https://youtu.be/s2EKGMa4-zM?si=oLEX79QlmZHpYA3H
	Multimedia authoring tools	https://youtu.be/ak1YOwsVzpE?si=RnkC44KhgYa2vSOX
Unit-II	Lossless and Lossy compression techniques	https://youtu.be/91WdRMWrJGU?si=Tl7iYxD9GsjN5Q4N
	JPEG image compression standards, MPEG video compression standards	https://youtu.be/42dWHkYh5Wo?si=n1Ls-d5oU4ecOwD3
Unit-III	Digital audio concepts and formats, Audio compression techniques	https://youtu.be/rC16fhvXZOo?si=Mfxm4R4uRXUSVRM0
	Animation principles and techniques.	https://youtu.be/NsJUKwvKRdw?si=3eUqWxprfopZQLHb
Unit-IV	Quality of Service (QoS) requirements	https://youtu.be/FqTvwttoTJ4?si=3ohurlLGUhXoU0YN
	Virtual Reality and Augmented Reality concepts	https://youtu.be/Uy1-mVplKVI?si=Kp0MClMgfUqlTAZM

Annexure AC / 5.14

~~ANNEXURE 4.6(a)~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)
An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations

For

Minor Degree/Honors (Hons.)/Specialization

in

Cyber Security

Department of Computer Science and Engineering

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

Minor Degree/Honors (Hons.)/Specialization
in
Cyber Security
Offered by the Department of Computer Science and Engineering

Cyber Security is an interdisciplinary field that combines computer science, information technology, and network engineering to protect digital systems, networks, and data from cyber threats. With the rapid expansion of digital infrastructure across industries, government services, and daily life, ensuring information security has become a critical priority. Recognizing its growing importance, the government is actively promoting education, research, and innovation in cyber security. Therefore, universities and institutions are encouraged to integrate cyber security into their academic programs.

In view of this, the **Department of Computer Science Engineering** has introduced a **Minor Degree/Honors (Hons.)/Specialization in "Cyber Security"** from the academic session **2026–27**. This program aims to enhance students' employability by providing specialized knowledge and practical skills in areas such as network security, ethical hacking, data protection, and cyber risk management—fields that are often not extensively covered in the regular undergraduate curriculum. The program will enable students to develop expertise in cyber security and prepare them for diverse career opportunities in this rapidly evolving domain.

This Minor Degree/Honors (Hons.)/Specialization will require earning 20 credits. It will be an addition to the regular undergraduate program, implying that passing or failing it will not affect the results of the regular undergraduate program being pursued by the student. Upon successful completion of the course, a Minor Degree/Honors (Hons.)/Specialization shall be awarded to the candidate. Students enrolled in B.Tech programs shall be eligible to pursue a Minor Degree/Honors (Hons.)/Specialization as outlined below:

Name of the Minor/Honors (Hons.)/Specialization Degree	**B.Tech Program whose students are eligible to opt for Minor Degree**	**B.Tech Program whose students are eligible to opt for Honors (Hons.)/Specialization**
Cyber Security	All Branches except Computer Science and Engineering, CSE-Artificial Intelligence and Machine Learning and CSE-Data Science	Computer Science and Engineering, CSE-Artificial Intelligence and Machine Learning and CSE-Data Science

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

Minor Degree/Honors (Hons.)/Specialization in Cyber Security

(Effective from the Session: 2026-27)

Sr. No	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in H
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	MCS-001	Information Security Fundamentals	3	0	0	3	3	30	45		75	3
2	IV	MCS-002	Cryptography and Secure Communication	3	1	0	4	4	40	60		100	3
3	V	MCS-003	Ethical Hacking and Penetration Testing	3	0	0	3	3	30	45		75	3
4	V	MCS-L003	Ethical Hacking and Penetration Testing Lab	0	0	2	2	1	10		15	25	
5	VI	MCS-004	Network Security	3	0	0	3	3	30	45		75	3
6	VI	MCS-L004	Network Security Lab	0	0	2	2	1	10		15	25	
7	VII	MCS-005	Cyber Laws and Ethics	3	0	0	3	3	30	45		75	3
8	VIII	MPCS-006	Project	0	0	4	4	2	20		30	50	
Total Credits								20				500	

Note: To earn the required credits for the award of B. Tech Minor Degree/Honors (Hons.)/Specialization, students may choose either:

(i) To enroll in courses offered through NPTEL/MOOCs that must be equivalent to the prescribed courses in the approved scheme, subject to availability in any semester.

OR

(ii) To complete the prescribed courses in the same semester as offered by the department under the approved scheme and curriculum structure.

<table>
<tr><td>Course code</td><td colspan="5">MCS-001</td></tr>
<tr><td>Course title</td><td colspan="5">Information Security Fundamentals</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To introduce fundamental concepts of information theory that underpin secure communication and cyber security systems.
• To develop conceptual understanding of secrecy, authentication, privacy, and cryptographic security principles used in cyber environments.
• To enable learners to reason about security mechanisms, attacks, and defences using information-theoretic and cryptographic models.
• To provide analytical perspective on emerging cyber security challenges, including threats, forensic considerations, and security guarantees.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define key concepts of information theory and secure communication relevant to cyber security.	Level 1: Remember
CO2	Explain theoretical principles underlying secrecy, authentication, privacy, and cryptographic security.	Level 2: Understand
CO3	Apply information-theoretic and cryptographic models to reason about security mechanisms and attacks.	Level 3 : Apply
CO4	Analyze cyber security scenarios by evaluating threats, security guarantees, and investigative approaches.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Shannon's foundation of Information theory, Random variables, Probability distribution factors, Uncertainty/entropy information measures, Leakage, Quantifying Leakage and Partitions, Lower bounds on key size for secrecy, authentication, and secret sharing, provable security, computational security, motivation for symmetric cipher systems, role of entropy in key generation and randomness.

Unit-II

Secrecy, Authentication, Secret sharing, Optimistic results on perfect secrecy, Secret key agreement, Unconditional Security, Quantum Cryptography, Randomized Ciphers, Types of codes- block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques.

Unit-III

Information-theoretic security and cryptography, basic introduction to Diffie-Hellman, AES, and side channel attacks. Secrecy metrics- strong, weak, semantic security, partial secrecy, Secure source coding, rate-distortion theory for secrecy systems, side information at receivers, Distributed channel synthesis.

Unit-IV

Cyber warfare: definition, evolution and objectives, cyberspace as a domain of warfare, cyber warfare vs cyber crime vs cyber terrorism, types of cyber warfare attacks including cyber espionage, sabotage, information warfare and DDoS attacks, nation-state cyber-attacks and cyber weapons.
Digital Forensics: introduction to digital and network forensics, digital forensic investigation process, types of digital evidence and sources, chain of custody and legal admissibility of digital evidence, role of digital forensics in incident response, connection of information theory concepts to modern cryptographic and forensic systems.

Suggested Readings:

1. Information Theory and Coding by Muralidhar Kulkarni and K. S. Shivaprakasha, John Wiley & Sons, 1st Edition.
2. Communication Systems: Analog and Digital by Singh and Sapre, Tata McGraw-Hill.
3. Fundamentals in Information Theory and Coding by Monica Borda, Springer, 1st Edition, 2011.
4. Information Theory, Coding and Cryptography by R. Bose, McGraw-Hill Education, 3rd Edition, 2008.
5. Information Security & Cyber Laws by Gupta & Gupta, Khanna Publishing House, 1st Edition, 2019.
6. "Multimedia System Design" by Prabhat K. Andleigh and Kiran Thakrar, Prentice Hall, 1st Edition, 1995.

Useful Video Links:

Unit No.	Topics	Links	Sources
Unit-I	Random Variable	https://youtu.be/snt3FVAVqHg?si=VPerGmbHCnbddfHv	NPTEL (IIT Delhi)
	Uncertainty/entropy information measures, Leakage	https://youtu.be/TT5Wm9jDR2A	NPTEL (IIT Bombay)
Unit-II	Secret Key Exchange (Diffie-Hellman)	https://youtu.be/2kfAga111ls?si=BCCh4CwcgUOdmV34	NPTEL (IIT Kharagpur)
	Quantum Cryptography	https://www.youtube.com/watch?v=BQhZpcg0sc4&list=PLyqSpQzTE6M8Pp2Z8kOAVyoSbw1UOPWQY	NPTEL (IIT Madras)
	Cyclic Codes	https://youtu.be/a_-vfzdvCFg?si=qeoPjw5h-GjT6ZpC	NPTEL (IIT Delhi)
Unit-III	AES	https://youtu.be/fMJl01wbmWE?si=Usn2dUJE9e_ZSwYd	NPTEL (IIT Kharagpur)
	Differential privacy	https://youtu.be/_wMBrZSBBow?si=2AsoeS0sl2RfQU1s	NPTEL (IIT Madras)
Unit-IV	Cyber Warfare	https://onlinecourses.nptel.ac.in/noc26_lw01/preview	Swayam (NALSAR University of Law)
	Digital Forensics	https://youtu.be/jEJYXu59ecQ?si=S2GjKBCqkwulGanI	YouTube (Mossé Cyber Security Institute)

Course code	**MCS-002**				
Course title	**Cryptography and Secure Communication**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To introduce the mathematical and algorithmic foundations of modern cryptography. • To explain formal security goals, definitions, and threat models used in cryptographic systems. • To familiarize students with symmetric-key primitives, block ciphers, and their provably secure constructions. • To develop an understanding of semantic, computational, and provable security concepts. • To enable students to analyze and reason rigorously about cryptographic security guarantees in secure communication systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental cryptographic primitives, security goals, and formal security models used in secure communication.	Level 1: Remember
CO2	Explain semantic and computational security, pseudorandom generators, and block cipher modes of operation.	Level 2: Understand
CO3	Apply provably secure constructions of cryptographic primitives such as PRGs, PRFs, and CPA-secure encryption schemes.	Level 3 : Apply
CO4	Analyze cryptographic definitions, reductions, and security proofs to evaluate the strength of secure communication mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction and Symmetric Key Foundations: Overview of cryptography and secure communication, historical ciphers and motivation for modern cryptography. Security goals: confidentiality, integrity, and authenticity. Symmetric-key encryption: syntax and threat models. Perfect secrecy and Shannon's theorem, limitations of perfect secrecy. Computational security and adversarial models. Formal definition of semantic security. Introduction to pseudorandom generators (PRGs) and their basic properties.

Unit-II

Pseudorandom Functions and Stream Ciphers: Provable security definitions for pseudorandom generators. Practical constructions and instantiations of secure PRGs. Stream ciphers: design principles, security requirements, and real-world examples. Pseudorandom functions (PRFs): definitions, constructions, and examples. Relationship between PRGs and PRFs and their role in secure communication protocols.

Unit-III

Block Ciphers and Modes of Operation: Block cipher fundamentals: definitions and security intuition. Construction of CPA-secure encryption schemes using PRFs. Standard block cipher modes of operation: ECB, CBC, and CTR modes. Security analysis and limitations of various modes. Principles of secure mode design. Provable security constructions based on block ciphers.

Unit-IV

Provable Security and Advanced Constructions: Introduction to provable security methodology. Game-based definitions and reduction-based proof techniques. Security of composition of cryptographic primitives. Advanced encryption notions: CCA security and authenticated encryption. Practical considerations in secure communication systems. Overview of real-world cryptographic standards and best practices.

Suggested Readings:

1. Foundations of Cryptography by Oded Goldreich, Volumes 1 & 2, Cambridge University Press.
2. Introduction to Modern Cryptography by Jonathan Katz & Yehuda Lindell, CRC Press.
3. Foundations of Cryptography Lecture Notes by Mihir Bellare & Phillip Rogaway.
4. A Graduate Course in Applied Cryptography by Dan Boneh & Victor Shoup, (freely available online).

Useful Video Links:

Course Name	Tutor	NPTEL Link
Foundations of Cryptography	Prof. Ashish Choudhury, IIT Madras	https://nptel.ac.in/courses/106106221

<table>
<tr><td>Course code</td><td colspan="5">MCS-003</td></tr>
<tr><td>Course title</td><td colspan="5">Ethical Hacking and Penetration Testing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To introduce ethical hacking principles, penetration testing methodologies, and legal–ethical frameworks.
To explain reconnaissance, system exploitation, malware, and network-based attacks from an attacker’s perspective.
To enable understanding of web, wireless, and cryptographic attack surfaces and basic defensive measures.
To familiarize students with digital forensics fundamentals, incident response, and emerging hacking trends.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define ethical hacking concepts, penetration testing processes, and legal–ethical considerations.	Level 1: Remember
CO2	Explain reconnaissance, system hacking techniques, malware behavior, and network attack mechanisms.	Level 2: Understand
CO3	Apply ethical hacking concepts to analyze web, wireless, and cryptographic security weaknesses.	Level 3 : Apply
CO4	Analyze forensic evidence, incident response processes, and emerging security challenges.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Foundations of Ethical Hacking and Reconnaissance: Ethical hacking: definition, scope, objectives, ethical vs unethical hacking, roles of ethical hackers, legal and regulatory framework in India. Penetration testing concepts, penetration testing vs vulnerability assessment, penetration testing life cycle, threat modeling, red teaming and blue teaming.

Reconnaissance and footprinting: passive and active reconnaissance, WHOIS and DNS interrogation, search engine hacking, OSINT, basic network scanning and enumeration.

Unit-II

System Hacking and Malware: System hacking techniques: authentication weaknesses, password attacks, privilege escalation, maintaining access, backdoors. Malware fundamentals: viruses, worms, Trojans, ransomware, botnets – characteristics and propagation. Malware analysis overview: static vs dynamic analysis, indicators of compromise.
Sniffing and spoofing attacks: packet sniffing concepts, ARP poisoning, DNS spoofing, session hijacking. Basic countermeasures: system hardening, endpoint security, intrusion detection overview.

Unit-III

Network, Web, and Wireless Attacks: Network attacks: DoS and DDoS concepts, man-in-the-middle attacks, routing and protocol abuse, Web application attacks: web attack surface, OWASP Top 10 vulnerabilities, SQL injection, XSS, CSRF, authentication and session flaws, Wireless attacks: wireless security standards (WEP, WPA, WPA2, WPA3), rogue access points, evil twin attacks, Bluetooth threats, Overview of defensive mechanisms: firewalls, web application firewalls, intrusion prevention systems.

Unit-IV

Cryptographic Attacks, Forensics, and Emerging Trends: Cryptography from an attacker's view: weak encryption usage, password storage flaws, brute force and rainbow table attacks, PKI overview: digital certificates, trust models, common PKI and SSL/TLS misconfigurations. Digital forensics fundamentals: investigation process, evidence acquisition, chain of custody, log and memory analysis. Incident response basics and cyber law overview in India, Emerging trends: cloud misconfigurations, IoT hacking basics, mobile security threats, social engineering.

Suggested Readings:

1. CEH Certified Ethical Hacker Study Guide by Ric Messier, 4th Edition, Wiley, 2019.
2. The Web Application Hacker's Handbook by Dafydd Stuttard and Marcus Pinto, 2nd Edition, Wiley, 2011.
3. Hacking: The Art of Exploitation by Jon Erickson, 2nd Edition, No Starch Press, 2008.
4. Computer Security: Principles and Practice by William Stallings and Lawrie Brown, 4th Edition, Pearson, 2018.

Useful Video Links:

Course Name	Tutor	NPTEL Link
Ethical Hacking	Prof. Indranil Sengupta, IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc23_cs44/preview

Course Code	**MCS-L003**				
Course Title	**Ethical Hacking and Penetration Testing Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To provide hands-on exposure to ethical hacking tools, techniques, and methodologies. ● To practice reconnaissance, scanning, exploitation, and basic post-exploitation activities in controlled environments. ● To analyze common system, network, web, and wireless vulnerabilities through laboratory experiments. ● To understand attacker techniques alongside basic defensive and forensic countermeasures. ● To develop ethical awareness, legal compliance, and responsible hacking practices.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand ethical hacking concepts, penetration testing methodology, and legal frameworks through practical demonstrations.	Level 2: Understand
CO2	Apply reconnaissance, scanning, and enumeration techniques using standard ethical hacking tools.	Level 3: Apply
CO3	Perform controlled exploitation of system, network, web, and wireless vulnerabilities.	Level 3: Apply
CO4	Analyze attacks, malware behavior, logs, and incident evidence to propose countermeasures.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1.	Install and configure an ethical hacking lab environment (Kali Linux/Parrot OS, Metasploitable, DVWA) and study ethical hacking laws and guidelines in India.	CO1
2.	Perform passive and active reconnaissance using WHOIS, DNS lookup, Google dorking, and OSINT tools.	CO2
3.	Network scanning and enumeration using Nmap: port scanning, service detection, OS fingerprinting.	CO2
4.	Perform vulnerability scanning using tools such as OpenVAS/Nessus; analyze scan reports.	CO2

5.	Demonstrate password attacks: dictionary and brute-force attacks on test systems using ethical tools.	CO3
6.	Perform privilege escalation and maintain access in a controlled lab environment.	CO3
7.	Study malware behavior using static and dynamic analysis tools; identify indicators of compromise.	CO2
8.	Demonstrate sniffing and spoofing attacks: packet capture, ARP poisoning, DNS spoofing in a sandbox.	CO3
9.	Exploit web application vulnerabilities (SQL Injection, XSS, CSRF) using OWASP DVWA / Juice Shop.	CO3
10.	Perform wireless security assessment: WEP/WPA attacks, evil twin simulation, Bluetooth scanning.	CO3
11.	Analyze cryptographic weaknesses: password hashing flaws, brute force and rainbow table attacks.	CO4
12.	Perform basic digital forensics: log analysis, memory dump inspection, evidence handling and chain of custody.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**	**Source**
Network scanning using Nmaps	https://labex.io/labs/nmap-how-to-scan-multiple-ip-addresses-simultaneously-using-nmap-in-cybersecurity-414798	Labex
Cryptographic attacks	https://overthewire.org/wargames/bandit/	overthewire.org
SQL injection	https://portswigger.net/web-security/sql-injection	portswigger.net

Course code	**MCS-004**				
Course title	**Network Security**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce secure network architectures, communication models, and fundamental principles of network security. • To explain transport, IP, wireless, email, and web security protocols with emphasis on secure design and vulnerability mitigation. • To familiarize students with network defense mechanisms, traffic monitoring, and incident response processes. • To enable analysis of emerging network security challenges in cloud, IoT, mobile, and zero-trust environments.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define network security concepts, secure architectures, threat models, and communication principles.	Level 1: Remember
CO2	Explain secure communication protocols, certificate infrastructures, and protocol-level vulnerabilities.	Level 2: Understand
CO3	Apply network defense mechanisms, monitoring tools, and mitigation strategies to protect communication systems.	Level 3 : Apply
CO4	Analyze advanced network security challenges, incident response scenarios, and emerging secure network architectures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Network security fundamentals: CIA triad in network communication, Authentication–Authorization–Accounting (AAA), threat models and attack surfaces, secure network design principles: defense-in-depth, segmentation, DMZ, trusted vs. untrusted zones, conceptual analysis of DNS hijacking, man-in-the-middle attacks, and distributed denial-of-service (DDoS) attacks (case-study based).

Unit-II

Secure communication protocols: SSL/TLS architecture, handshake and record protocols, digital certificates and PKI, certificate pinning and HSTS, analysis of TLS vulnerabilities (BEAST, POODLE, Heartbleed) and mitigation strategies, IPSec architecture, AH and ESP headers, transport and tunnel modes, Internet Key Exchange (IKE), Virtual Private Networks (VPNs): site-to-site and remote-access VPNs.

Unit-III

Network defense and monitoring mechanisms: firewalls (packet filtering, stateful inspection, proxy and next-generation firewalls), Network Address Translation (NAT), Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS), signature-based and anomaly-based detection, Security Information and Event Management (SIEM) fundamentals, log collection and correlation, network traffic monitoring, anomaly detection, network-level incident response and forensic readiness.

Unit-IV

Advanced network security and emerging trends: wireless, email, and web security (secure configuration and protection), wireless security standards (WEP, WPA, WPA2, WPA3) and KRACK vulnerability analysis, email security (PGP, S/MIME), web security mechanisms (HTTPS, secure cookies, DNSSEC), cloud network security (VPCs, cloud firewalls, Web Application Firewalls, zero-trust models), IoT network security fundamentals, Zero Trust Network Architecture (ZTNA), Secure Access Service Edge (SASE), AI/ML-based network anomaly detection, post-quantum cryptography impact on network protocols.

Suggested Readings:

1. Network Security Essentials: Applications and Standards by William Stallings, 6th Edition, Pearson.
2. Cryptography and Network Security: Principles and Practice by William Stallings, 8th Edition, Pearson.
3. Computer Security: Principles and Practice by William Stallings & Lawrie Brown, Pearson.
4. Network Security Bible by Eric Cole, Wiley.
5. Applied Cryptography by Bruce Schneier, Wiley.
6. Network Security: Private Communication in a Public World by Kaufman, Perlman & Speciner, Prentice Hall.
7. Encyclopedia of Cryptography and Security by Henk C.A. van Tilborg (Ed.), Springer.

Useful Video Links:

Course Name	Tutor	NPTEL Link
Network Security	Prof. Gaurav S. Kasbekar, IIT Bombay	https://nptel.ac.in/courses/108101585?

Course Code	**MCS-L004**				
Course Title	**Network Security Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To understand network security fundamentals, threats, and cryptographic mechanisms through hands-on experiments. ● To apply transport, IP-layer, wireless, email, and web security protocols in practical network environments. ● To configure and analyze network defense mechanisms including firewalls, IDS/IPS, and monitoring tools. ● To investigate network attacks, perform forensics, and study emerging trends such as cloud, IoT, and zero-trust security.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand network security principles, threats, cryptographic foundations, and secure network architectures.	Level 2: Understand
CO2	Apply security protocols and mechanisms at transport, IP, wireless, email, and web layers.	Level 3: Apply
CO3	Implement and configure firewalls, IDS/IPS, traffic monitoring, and secure network services.	Level 3: Apply
CO4	Analyze network attacks, security incidents, forensics evidence, and effectiveness of modern defense strategies.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Install and configure Linux networking tools; study CIA triad, AAA, and basic cryptographic primitives.	CO1
2	Perform packet sniffing and traffic analysis using Wireshark; study plaintext credential leakage.	CO2
3	Implement and analyze spoofing attacks (ARP poisoning, MAC spoofing) in a controlled lab setup.	CO2
4	Perform scanning and reconnaissance using Nmap; analyze attack surface exposure.	CO2
5	Configure SSL/TLS; analyze handshake, certificates, PKI, HSTS, and certificate pinning.	CO2

6	Study TLS vulnerabilities Heartbleed, POODLE, BEAST) using simulations and test environments.	CO3, CO4
7	Configure IPSec in transport and tunnel modes; implement site-to-site and remote-access VPNs.	CO3
8	Implement wireless security: WEP/WPA/WPA2/WPA3 configuration; analyze 4-way handshake and KRACK.	CO3
9	Configure firewall rules (packet filtering, stateful, NAT, DMZ); analyze traffic behavior.	CO3
10	Deploy IDS/IPS (Snort/Suricata); analyze alerts and intrusion patterns.	CO4
11	Simulate DDoS attacks (SYN flood, UDP flood); study mitigation strategies and logging.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links

Experiment Name	Virtual Lab Link	Source
TCP SYN Flood attack	https://ns-amrt.vlabs.ac.in/exp/tcp-syn-flood/	Virtual Labs
To simulate the Secure Socket Layer (SSL) transmission between a user and a server	https://ns-amrt.vlabs.ac.in/exp/ssl-simulation/	Virtual Labs
Intrusion Detection Systems (IDS)	https://ns-amrt.vlabs.ac.in/exp/intrusion-detection/	Virtual Labs
Intrusion prevention system using firewalls	https://ns-amrt.vlabs.ac.in/exp/firewall/	Virtual Labs

Course code	**MCS-005**				
Course title	**Cyber Laws and Ethics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VII**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the foundations of cyber law, cyberspace, and cyber jurisprudence. • To familiarize learners with the Information Technology Act, cyber-crimes, and electronic governance. • To outline cyber law in relation to intellectual property, allied laws, and dispute resolution. • To highlight cyber ethics, cyber regulations, and ethical issues in artificial intelligence.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental terms and concepts related to cyber law, cyberspace governance, cyber-crimes and cyber ethics.	Level 1: Remember
CO2	Explain the legal, regulatory and ethical frameworks governing activities and interactions in cyberspace, including emerging digital technologies.	Level 2: Understand
CO3	Apply cyber law principles and statutory provisions to address practical issues and case scenarios arising in digital environments.	Level 3: Apply
CO4	Analyze the broader implications of cyberspace technologies by evaluating legal compliance, ethical challenges and responsible use in contemporary society.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Cyber Law: Evolution of computer technology, emergence of cyber space, cyber jurisprudence, jurisprudence and law, doctrinal approach, consensual approach, real approach, cyber ethics, cyber jurisdiction, hierarchy of courts, civil and criminal jurisdictions, cyberspace web-space, web hosting and web development agreement, legal and technological significance of domain names, Internet as a tool for global access.

Unit-II

Information Technology Act: Overview of IT Act 2000, amendments and limitations of IT Act, digital signatures, cryptography, electronic governance, legal recognition of electronic records, legal recognition of digital signature, certifying authorities, cyber crime and offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

Unit-III

Cyber Law and Related Legislation: Patent Law, Trademark Law, Copyright, Software Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).

Unit-IV

Cyber Ethics: Introduction to Cyber ethics, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles.

Suggested Readings:

1. Textbook on Cyber Law by Pavan Duggal, Deccan Law House, 2007.
2. Cyber Law Simplified by Vivek Sood, Tata McGraw-Hill Publishing Company, 2001.
3. Cyber Laws, Information Technology and Artificial Intelligence by Jyoti Rattan, Eastern Book Company (EBC), 2023.
4. Introduction to Computer Security by Matt Bishop, Pearson Education, 2003.
5. Cyber Law and Cyber Crimes by Dr. Santosh Kumar and Dr. Gagandeep Kaur, Eastern Book Company (EBC), 2020.

Useful Video Links:

Unit No.	Topics	Links	Sources
Unit-I	Introduction to Cyber Laws	https://onlinecourses.swayam2.ac.in/cec24_cs14/preview	NPTEL (Punjabi University, Patiala)
	Cyber Security and Privacy	https://onlinecourses.nptel.ac.in/noc23_cs127/preview	NPTEL (IIT Madras)
Unit-II	Cryptography	https://youtu.be/B-Xe7_mf2CY?si=KuOwiHqLmyZXTzxH	NPTEL (IIT Kharagpur)
	Sections 11, 12, and 13 of Information Technology Act, 2000	https://www.youtube.com/watch?v=0BbBRRVX_l4	YouTube (Asian School of Cyber Laws)
Unit-III	Patent Law, Trademark Law, Copyright	https://youtu.be/xeAtjYoMa1A?si=53PJ532fA0NW2c2t	YouTube (Dhaval Chandarana)
	Indian patent act, 1970	https://youtu.be/8VGW5Y81SxU?si=-tjk0r-Nl02jIXVl	YouTube (Lawlecture by TarunaSharma)
Unit-IV	Introduction of Cyber Ethics	https://youtu.be/xeDZalBaLkQ?si=L0cCFKcxLJmOWXKF	YouTube (Dhaval Chandarana)
	Ethics in information society	https://onlinecourses.nptel.ac.in/noc23_hs47/preview	YouTube (IIT Bangalore)

<table>
<tr><td>Course code</td><td colspan="5">MPCS-006</td></tr>
<tr><td>Course title</td><td colspan="5">Project</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VIII</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To identify an engineering problem through literature review and clearly define project objectives.
To learn fundamental engineering principles to propose a feasible solution methodology.
To inculcate skills in project planning, preliminary design, and use of appropriate engineering tools.
To enhance teamwork, technical documentation, and presentation skills.</td></tr>
<tr><td>Assessment</td><td colspan="5">20 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">30 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

The students expected to take up a project under the guidance of teacher from the college. The Project must be based on **Cyber Security** problems, which can be extended up to the full semester. The students may be asked to work individually or in a group normally not more than three students in a group (if any large/ big projects occur then strength of students' can be increased as per guide supervision). Viva-voce must be based on the preliminary reports submitted by the students related to the project.

Annexure AC / 5.16

ANNEXURE 4.6(b)

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)
An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations

For

Minor Degree

in

Data Science

Department of Computer Science and Engineering

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

Minor Degree
in
Data Science
Offered by the Department of Computer Science and Engineering

Data Science is an interdisciplinary field that integrates computer science, statistics, and mathematics to extract meaningful insights from large and complex datasets. With the rapid growth of digital technologies and data-driven decision-making across industries, government services, and research domains, the demand for skilled data science professionals has increased significantly. Recognizing its importance, the government is actively promoting education, research, and innovation in data science and related technologies. Therefore, universities and institutions are encouraged to incorporate data science into their academic programs.

In view of this, the **Department of Computer Science and Engineering** has introduced a **Minor Degree in "Data Science"** from the academic session **2026–27**. This program aims to enhance students' employability by providing specialized knowledge and practical skills in areas such as data analytics, machine learning, data visualization, and big data technologies fields that are often not extensively covered in the regular undergraduate curriculum. The program will enable students to develop expertise in data science and prepare them for diverse career opportunities in this rapidly evolving domain.

This Minor Degree will require earning 20 credits. It will be an addition to the regular undergraduate program, implying that passing or failing it will not affect the results of the regular undergraduate program being pursued by the student. Upon successful completion of the course, a Minor Degree shall be awarded to the candidate. Students enrolled in B.Tech programs shall be eligible to pursue a Minor Degree, as outlined below:

Name of the Minor	**B.Tech Program whose students are eligible to opt for Minor Degree**
Data Science	All Branches except Computer Science and Engineering, CSE-Artificial Intelligence and Machine Learning and CSE-Data Science

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

Minor Degree in Data Science

(Effective from the Session: 2026-27)

Sr. No.	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in H
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	MDS-001	Mathematics for DS	3	1	0	4	4	40	60		100	3
2	IV	MDS-002	Fundamentals of DS	3	0	0	3	3	30	45		75	3
3	V	MDS-003	Data Preparation and Preprocessing	3	0	0	3	3	30	45		75	3
4	V	MDS-L003	Data Preparation and Preprocessing Lab	0	0	2	2	1	10		15	25	
5	VI	MDS-004	Data Handling and Visualization	3	0	0	3	3	30	45		75	3
6	VI	MDS-L004	Data Handling and Visualization Lab	0	0	2	2	1	10		15	25	
7	VII	MDS-005	Big Data Analytics	3	0	0	3	3	30	45		75	3
8	VIII	MPDS-006	Project	0	0	4	4	2	20		30	50	
Total Credits								20				500	

Note: To earn the required credits for the award of B. Tech Minor Degree, students may choose either:

(i) To enroll in courses offered through NPTEL/MOOCs that must be equivalent to the prescribed courses in the approved scheme, subject to availability in any semester.

OR

(ii) To complete the prescribed courses in the same semester as offered by the department under the approved scheme and curriculum structure.

<table>
<tr><td>Course code</td><td colspan="5">MDS-001</td></tr>
<tr><td>Course title</td><td colspan="5">Mathematics for DS</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To introduce the fundamentals of probability theory and random variables for modeling uncertainty in data science.
To develop understanding of discrete and continuous probability distributions and statistical measures for data analysis.
To enable application of estimation methods and descriptive statistics for parameter inference.
To cultivate skills in hypothesis testing and statistical decision-making for data-driven conclusions.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts of probability, random variables, probability distributions, and statistical inference.	Level 1: Remember
CO2	Explain properties of discrete and continuous distributions, estimation methods, and hypothesis testing principles.	Level 2: Understand
CO3	Apply probability models, estimation techniques, and statistical tests to solve data-driven problems.	Level 3 : Apply
CO4	Analyze statistical data using distribution theory, correlation measures, and hypothesis testing frameworks to draw meaningful conclusions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Foundations of Probability Theory: Random experiments and events, Definitions of probability and basic properties of probability functions. Conditional probability, independence of events. Problems on probability. Definition of random variables, probability distribution of a random variable, discrete and continuous distributions. Special discrete distributions: Bernoulli, Binomial, Geometric, Poisson. Introduction to discrete processes: Poisson process.

Unit-II

Continuous Distributions: Special continuous distributions – Exponential, Gamma, Beta, Uniform and related families; Normal distribution and applications. Joint distributions (discrete and continuous), independence, product moments, correlation, bivariate normal distribution, additive properties of distributions. Distribution of order statistics.

Unit-III

Descriptive Statistics: Measures of central tendency, dispersion, quantiles, moments, measures of skewness and kurtosis.
Estimation Theory: Concepts of unbiasedness, consistency, method of moments estimation (MME), maximum likelihood estimation (MLE).

Unit-IV

Hypothesis Testing: Basic definitions of hypothesis testing, types of errors. Tests for normal mean and variance, large-sample tests for variance, two-sample problems, paired t-test, testing equality of proportions. Sampling distributions – Chi-square, t-distribution and F-distribution.

Suggested Readings:

1. An Introduction to Probability and Statistics by V. K. Rohatgi and A. K. Md. E. Saleh, 3rd Edition, Wiley Series in Probability and Statistics, 2015.
2. Probability and Statistical Inference by R. V. Hogg, E. A. Tanis, and J. M. Rao, 7th Edition, Pearson Education, New Delhi, 2009.
3. John E. Freund's Mathematical Statistics with Applications" by Irwin Miller and Marylees Miller, 7th Edition, Pearson Education, Asia, 2006.
4. Fundamentals of Statistics, Vol. I by A. M. Goon, M. K. Gupta, and B. Dasgupta, 8th Edition, The World Press, Kolkata, 2002.
5. An Introduction to the Theory of Statistics by G. U. Yule and M. G. Kendall, 14th Edition, Universal Book Stall, Delhi, 1994.

Useful Video Links:

Unit No.	Topics	Links	Source
Unit-I	Random experiments, sample space, events	https://youtu.be/r1sLCDA-kNY?si=YjBpSNfFcBNXuixd	NPTEL (IIT Kharagpur)
	Conditional probability & independence	https://youtu.be/o1qL2Eb87Ew?si=ZT6TZex4bKfUGklD	NPTE (IIT Guwahati)
	Special discrete distributions: Bernoulli, Binomial, Geometric, Poisson	https://youtu.be/dByGT1N8JAw?si=HKeIgCFrGXyg4yTl	NPTEL (IISC Bengaluru)
Unit-II	Normal distribution	https://youtu.be/GMcfFrsfBQU	NPTEL (IIT Kharagpur)
	Joint distribution	https://youtu.be/S_Zx-g8FU0w?si=ECEKIcSgAt4ICPq3	NPTEL (IIT Kharagpur)
	Order Statistics	https://youtu.be/E_sJQML1PMg?si=UFtbHnBcDhgT6ZrA	NPTEL (IIT Guwahati)
Unit-III	Moments	https://youtu.be/rlFR9Co8UgY?si=mrx7EcVotJtbxzAF	NPTEL (IIT Delhi)
	Maximum Likelihood Estimation	https://youtu.be/iXyMDeYqwaQ?si=og7R9e-rw_wvvBtF	NPTEL (IIT Guwahati)
Unit-IV	Hypothesis testing	https://youtu.be/6zslEdMGGiQ?si=v7L3lsCWuLR5W6TE	NPTEL (IIT Kharagpur)
	The Chi-Square Test	https://youtu.be/qUQ-alqJQag?si=lP3JMaggYy9lqv7q	NPTEL(IISER Kolkata)
	t and F Distribution	https://youtu.be/ZJHXVVjl1ns?si=XxJRVa06VOvjx4GY	NPTEL (IIT Kanpur)

<table>
<tr><td>Course code</td><td colspan="5">MDS-002</td></tr>
<tr><td>Course title</td><td colspan="5">Fundamentals of DS</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To understand the fundamentals and evolution of Data Science, including Big Data, Little Data, Machine Learning, Artificial Intelligence, and Data Analytics.
To learn the types of data, challenges in data science, and the role of a data scientist in handling and processing data effectively.
To acquire skills in statistical modeling, Python programming, and data handling techniques to analyze datasets and solve practical problems.
To develop the ability to analyze real-world datasets and design simple recommendation systems using statistical reasoning, Python tools, and utility matrices.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall and define the basic terminology, concepts, and scope of Data Science.	Level 1: Remember
CO2	Explain the data science process, types of data, and statistical foundations used in data analysis and decision-making..	Level 2: Understand
CO3	Apply statistical techniques and Python programming constructs to perform basic data analysis, file handling, and exception handling tasks.	Level 3 : Apply
CO4	Analyze real-world data problems and recommendation systems using statistical reasoning, Python-based approaches, and utility matrix concepts.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Evolution and scope of Data Science, Big Data vs Little Data, Data Science vs. Data Analytics vs. ML vs. AI, Types of data (structured, semi-structured, unstructured), Data Science life cycle / process, Challenges in data science, Data science process & role of a data scientist, Applications of Data Science in real-world domains (business, healthcare, social media).

Unit-II

Statistical Modeling for Data Science: Descriptive statistics (mean, median, mode, variance, standard deviation), Probability distributions (normal, binomial, Poisson), Sampling methods (Simple random sampling, Stratified sampling, Systematic sampling), Hypothesis testing, null and alternative hypotheses, Type-I and Type-II errors, Basics of confidence intervals.

Unit-III

Python for Data Science: Introduction to Python and its role in Data Science, Python basics, control structures, Data structures (lists, dictionaries), Files and exception handling, Python Libraries for Data Science (Introductory): NumPy (arrays and numerical operations), Pandas (Series, Data Frames, basic data manipulation), Matplotlib and Seaborn (basic data visualization).

Unit-IV

Recommendation systems: Introduction to recommendation systems, Types of recommendation systems (overview): Content-based, Collaborative filtering**,** Utility matrix and long tail concept, Applications and populating the utility matrix, Applications of recommendation systems.

Suggested Readings:

1. Python for Data Analysis, Second Edition – Wes McKinney, 2017, O'Reilly Media.
2. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed., 2009.
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI, 2010.
4. Artificial intelligence, Patrick Henry Winston, 1992, Addition Wesley.

Useful Video Links:

Unit No.	Topics	Links	Source
Unit-I	Evolution & scope, Big vs Little Data	https://www.youtube.com/watch?v=tA42nHmmEKw	NPTEL (IIT Madras)
	AI vs ML vs Data Science	https://www.youtube.com/watch?v=tA42nHmmEKw	NPTEL (IIT Madras)
	Types of data, challenges	https://www.youtube.com/watch?v=tA42nHmmEKw	NPTEL (IIT Madras)
Unit-II	Descriptive statistics	https://www.youtube.com/playlist?list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE	NPTEL (IIT Madras)
	Mean/median/mode	https://www.youtube.com/playlist?list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE	NPTEL (IIT Madras)
	Sampling	https://www.youtube.com/playlist?list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE	NPTEL (IIT Madras)
Unit-III	Python basics	https://www.youtube.com/playlist?list=PLyqSpQzTE6M_fFg1zZmeGIkenMDgXKGYi	NPTEL (IIT Madras)
	File & exception handling	https://www.youtube.com/playlist?list=PLyqSpQzTE6M_fFg1zZmeGIkenMDgXKGYi	NPTEL (IIT Madras)
Unit-IV	Utility matrix	https://www.youtube.com/playlist?list=PLOAciEalMV3Hqaau-IJo_cR9k2k76ErJl	NPTEL (IIT Madras)
	Long-tail concept	https://www.youtube.com/playlist?list=PLOAciEalMV3Hqaau-IJo_cR9k2k76ErJl	NPTEL (IIT Madras)

Course code	**MDS-003**				
Course title	**Data Preparation and Preprocessing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the role of data preparation in the data science lifecycle. • To develop practical skills for cleaning, transforming, and preprocessing data using Python libraries. • To enable students to handle real-world data quality issues programmatically. • To enable students to design reproducible data preprocessing workflows using standard tools.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the concepts, techniques, and workflows of data preparation, cleaning, transformation, feature engineering, and integration in data science.	Level 1: Remember
CO2	Explain methods for handling data quality issues, missing values, outliers, and preparing datasets for analysis and modeling.	Level 2: Understand
CO3	Apply data preprocessing, feature engineering, encoding, scaling, and integration techniques to prepare datasets for machine learning.	Level 3 : Apply
CO4	Analyze data preprocessing strategies, evaluate workflow effectiveness, and ensure readiness of datasets for modeling and deployment.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Data Preparation: Role of data preparation in data science; Types of data and data sources; Data quality dimensions and common issues; Data preprocessing workflow; Introduction to Python data science environment; Overview of NumPy and Pandas; Loading, inspecting, and summarizing datasets.

Unit-II

Data Cleaning and Missing Data Handling: Data cleaning process; Detection of missing values; Missing data treatment methods; Handling noisy data and outliers; Duplicate and inconsistent data handling; Data validation and integrity checks using standard techniques.

Unit-III

Data Transformation and Feature Engineering: Data transformation concepts; Normalization and standardization; Scaling techniques – Min-Max, Z-score, Robust scaling; Encoding categorical variables – label

encoding and one-hot encoding; Discretization and binning; Feature construction and extraction; Logarithmic and power transformations; Introduction to feature selection methods.

Unit-IV

Data Integration and Model Readiness: Data integration techniques; Dataset merging and joining; Data aggregation and grouping; Handling data from multiple sources; Dimensionality reduction concepts; Sampling techniques; Data reduction strategies; Preparing datasets for machine learning models; Train-test split; Cross-validation readiness; Reproducible preprocessing workflows.

Suggested Readings:

1. Python for Data Analysis by Wes McKinney, 2nd Edition, O'Reilly Media, 2018.
2. Python Data Science Handbook – Jake VanderPlas, 2016, O'Reilly Media
3. Python for Data Analysis by Wes McKinney, 3rd Edition, O'Reilly Media, 2022.
4. Python Data Science Handbook: Essential Tools for Working with Data by Jake VanderPlas, 1st Edition, O'Reilly Media, 2016.
5. Data Wrangling with Python – Jacqueline Kazil, Katharine Jarmul, 2016, O'Reilly Media.4.
6. Practical Statistics for Data Scientists, Second Edition – Peter Bruce, Andrew Bruce, 2020, O'Reilly Media.
7. Data Science from Scratch: First Principles with Python by Joel Grus, 2nd Edition, O'Reilly Media, 2019.
8. Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists – Alice Zheng, Amanda Casari, 2018, O'Reilly Media.

Useful Video Links:

Unit No.	Topics	Links	Source
Unit-I	Role of data preparation in data science	https://onlinecourses.nptel.ac.in/noc22_cs32/preview	NPTEL (IIT Madras)
	Introduction to Python data science environment	https://www.youtube.com/watch?v=tA42nHmmEKw	NPTEL (IIT Madras)
	Introduction to Numpy library	https://www.youtube.com/watch?v=O0IrNk1qoUE&list=PLZ2ps__7DhBb2cXAu5PevO_mzgS3Fj3Fs&index=90	NPTEL (IIT Madras)
	Why Pandas	https://www.youtube.com/watch?v=HCxhHo8tV4U&list=PLZ2ps__7DhBb2cXAu5PevO_mzgS3Fj3Fs&index=91	NPTEL (IIT Madras)
Unit-II	Data Cleaning with Python	https://www.youtube.com/watch?v=ZX8vmcSTCrc	YouTube (Tech Classes)
	Handling noisy data and outliers	https://www.youtube.com/watch?v=s8wUe49kKMU	NPTEL (IIT Bombay)
Unit-III	Feature Engineering	https://www.youtube.com/watch?v=BdL-cKUG4hE	YouTube (Intellipaat)
	Min-Max & Z-score Techniques	https://www.youtube.com/watch?v=lggqjmQzsGI	YouTube (Gate Smashers)
Unit-IV	Basics of Data Integrations	https://www.youtube.com/watch?v=3_12AZ0CEeo	YouTube (365 Data Science)
	Nonlinear Dimensionality Reduction Techniques -I	https://www.youtube.com/watch?v=841lv79yUUQ	NPTEL(IISc Bengaluru)
	Train, Test, & Validation Sets	https://www.youtube.com/watch?v=ZblqTCFnH-M	YouTube (Greg Hogg)

Course Code	**MDS-L003**				
Course Title	**Data Preparation and Preprocessing Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To enable students to implement Python programs for loading and summarizing datasets using NumPy and Pandas. ● To guide students in performing data cleaning by handling missing values, duplicates, inconsistencies, and outliers. ● To provide hands-on practice in applying data transformation techniques such as scaling, encoding, and feature engineering. ● To train students to prepare integrated and model-ready datasets using sampling and validation strategies.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Implement dataset loading, inspection, and summarization using NumPy & Pandas.	Level 2: Understand
CO2	Perform data cleaning, missing value handling, and data validation.	Level 3: Apply
CO3	Apply data transformation and feature engineering techniques for preprocessing.	Level 3: Apply
CO4	Analyze and organize datasets to create model-ready data using appropriate sampling, reduction, and splitting strategies.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Install and explore Python data science environment (NumPy, Pandas, Matplotlib).	CO1
2	Load datasets and perform inspection and statistical summary.	CO1
3	Detect and handle missing values using different techniques.	CO2
4	Identify and treat noisy data and outliers.	CO2
5	Remove duplicate and inconsistent records.	CO2
6	Perform normalization and standardization (Min-Max, Z-Score, Robust scaling).	CO3
7	Encode categorical variables using Label Encoding and One-Hot Encoding.	CO3
8	Perform discretization and binning of continuous data.	CO3

9	Construct new features and perform feature extraction.	CO3
10	Apply feature selection methods (filter-based techniques).	CO4
11	Merge and join datasets from multiple sources.	CO4
12	Perform data aggregation and grouping operations.	CO4
13	Apply sampling techniques and dimensionality reduction.	CO4
14	Prepare dataset for machine learning (train-test split and cross-validation readiness).	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**	**Source**
Load Dataset & Summary	https://colab.research.google.com/drive/1M8xTPtJVcY5UZTZusL6jiqooRBamkYen?usp=sharing	Google Colab
Missing Value Handling	https://colab.research.google.com/drive/1M8xTPtJVcY5UZTZusL6jiqooRBamkYen?usp=sharing	Google Colab
Encode categorical variables	https://colab.research.google.com/drive/1M8xTPtJVcY5UZTZusL6jiqooRBamkYen?usp=sharing	Google Colab

Course code	**MDS-004**				
Course title	**Data Handling and Visualization**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to Python-based data handling tools and structured data preparation techniques required for effective visualization. • To develop the ability to create clear, well-structured, and customizable static visualizations for exploratory and explanatory analysis. • To enable students to analyze multivariate and time-oriented data using appropriate statistical and advanced visualization techniques. • To cultivate skills in interactive visualization and data storytelling while emphasizing ethical and responsible visual communication.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall Python libraries, data structures, plotting functions, and basic visualization concepts for exploratory data analysis.	Level 1: Remember
CO2	Explain visualization components, design principles, plot types, and techniques for effective data storytelling and communication.	Level 2: Understand
CO3	Apply Python tools to create, customize, and analyze static and interactive visualizations for datasets using Matplotlib, Seaborn, and Plotly.	Level 3 : Apply
CO4	Analyze datasets visually, compare plotting methods, detect patterns, and interpret multivariate, temporal, and interactive visual insights.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Data Handling Basics: Overview of Python libraries: Pandas, NumPy, Matplotlib, Seaborn, Plotly, Understanding DataFrames in Pandas (structure differences vs R), Data loading using Pandas: from CSV, Excel, JSON, URL, Basic DataFrame manipulations: indexing, slicing, merging, grouping, Introduction to tidy data in Python.

Unit-II

Basics of Visualization Analytics Problems: Key Visualization Concepts, Visualization goals, communication, perception, clarity, Plot components: figure, axes, ticks, labels, legends, themes, Creating basic plots in Matplotlib: line chart, bar chart, pie chart, Customizing plots: colors, markers, grids, annotations, Subplots and layout management (Matplotlib gridspec, subplot2grid), Color palettes, themes, style settings, Enhanced barplots, countplots, distribution plots, PairGrid, FacetGrid concepts.

Unit-III

Statistical & Multivariate Visualization: Violin plots, Boxen plots, Jointplots & pairplots, Heatmaps for categorical & correlation data, Clustermaps.
Time & Multi-Dimensional Visualization: Multi-axis plots, Rolling window visualization, Bubble charts, spider/radar charts, Area charts, stacked charts.

Unit-IV

Plotly Interactive Visualization: Introduction to Plotly, Interactive line, bar, scatter plots, Plotly Express vs. Plotly Graph Objects, Interactive legends, hover labels, animations, 3D visualizations (surface, scatter3D, mesh plots).
Plotly Interactive Visualization: Visualization for insights vs. aesthetics, Data storytelling principles, Layout design for dashboards (Plotly Dash – conceptual only), Choosing effective chart types, Ethical visualization: misleading charts, scale distortions.

Suggested Readings:

1. Python for Data Analysis by Wes McKinney, O'Reilly Media, 2018.
2. Python Data Science Handbook by Jake VanderPlas, O'Reilly Media, 2016.
3. Python Data Visualization Essentials Guide by Kalilur Rahman, BPB Publications, 2021.
4. Data Visualization with Python and JavaScript by Kyran Dale, O'Reilly Media, 2016.
5. Mastering Matplotlib by Kirthi Raman, Packt Publishing, 2015.

Useful Video Links:

Unit No.	Topics	Links	Sources
Unit-I	Data Frames in Pandas	https://youtu.be/6DTFIKF8QIg?si=en5tm53K2XQN6Mw9	NPTEL (IIT Madras)
	Data loading	https://youtu.be/On6rLc1l_MU?si=tZvRvW-7ZL2PKaj7	NPTEL (IIT Madras)
	Numpy	https://youtu.be/rjY59WLMK2o?si=q92faGhp3hT69w_X	NPTEL (IIT Madras)
Unit-II	Matplotlib	https://youtu.be/eFByJkA3ti4?si=cJ0ncTkbPsvA2i2p	NPTEL (IIT Madras)
	Plot components: figure, axes	https://youtu.be/eFByJkA3ti4?si=gcSAChRE0sMu_yIv	NPTEL (IIT Madras)
Unit-III	Jointplots & pairplots	https://youtu.be/JhK2qVi5dC4?si=0mVubJza7r5s-6xp	NPTEL (IIT Madras)
	Spider Graph	https://youtu.be/ONtrmxyxTsw?si=xMClNbs2Wb5tjTEZ	NPTEL (IIT Madras)
Unit-IV	Scatter plots	https://youtu.be/eFByJkA3ti4?si=WAMwmAUPQlirnsI1	NPTEL (IIT Madras)

<table>
<tr><td>Course Code</td><td colspan="5">MDS-L004</td></tr>
<tr><td>Course Title</td><td colspan="5">Data Handling and Visualization Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To explore Python visualization libraries (Matplotlib, Seaborn, Pandas, Plotly) to represent data effectively.
To visualize trends, distributions, and comparisons using line charts, bar/column charts, pie/donut charts, and histograms.
Analyze relationships and detect patterns through scatter plots, correlation plots, box plots, and violin plots.
To Create advanced visualizations like 3D plots, heatmaps, and stacked charts for complex datasets.</td></tr>
<tr><td>Assessment</td><td colspan="5">10 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">15 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">25 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Identify and use major Python data visualization libraries (Matplotlib, Seaborn, Pandas, Plotly) for handling different types of data.	Level 2: Understand
CO2	Apply suitable visualization techniques (line, bar, pie, histogram) to represent trends, categorical data, proportions, and distributions.	Level 3: Apply
CO3	Construct advanced and interactive visualizations including scatter plots, 3D plots, heatmaps, and stacked bar charts using Seaborn and Plotly.	Level 3: Apply
CO4	Analyze multivariate datasets to interpret relationships, correlations, and statistical variations using box plots, violin plots, and correlation plots.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	To study and explore data visualization libraries in Python, including Matplotlib, Seaborn, Pandas, and Plotly.	CO1
2	Write a Python program to visualize data trends over time using line charts.	CO2
3	Write a Python program to compare categorical data using bar charts and column charts.	CO2
4	Write a Python program to represent proportions and percentages using pie charts and donut charts.	CO2
5	Write a Python program to analyze data distribution using histograms.	CO2
6	Write a Python program to identify relationships and correlations between variables using scatter plots and correlation plots.	CO3 CO4

7	Write a Python program to visualize statistical summaries and detect outliers using box plots and violin plots.	CO4
8	Write a Python program to draw 3D plots using the Plotly library.	CO3
9	Write a Python program to generate a 6×6 heatmap using random data and visualize it with Seaborn.	CO3
10	Write a Python program to plot a stacked bar chart displaying sales of multiple products across different quarters.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**	**Source**
Visualize data trends over time using line charts	https://colab.research.google.com/github/ageron/handson-ml2/blob/master/tools_matplotlib.ipynb	Google Colab
Represent proportions and percentages using pie charts and donut charts	https://colab.research.google.com/drive/1NsncQ_M5W5F8Z03nOj713Wjf_eW8k0AQ?usp=sharing	Google Colab
Draw 3D plots using the Plotly library	https://colab.research.google.com/drive/1-luSy55lQQrpNhJ_-W_w__rdaBgtNub0?usp=sharing	Google Colab

Course code	**MDS-005**				
Course title	**Big Data Analytics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VII**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals of Big Data, its characteristics, challenges, and the data science process. • To familiarize students with Big Data platforms, data repositories, data ecosystems, and data formats. • To develop the ability to apply Big Data modeling, storage, ingestion, and management techniques for scalable systems. • To enable students to analyze Big Data integration and processing pipelines using appropriate tools and workflow management systems.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental concepts of Big Data, its characteristics (Six V), data science process, and foundations of Big Data systems.	Level 1: Remember
CO2	Explain Big Data platforms, data repositories, data types, file formats, and modern data ecosystem components.	Level 2: Understand
CO3	Apply appropriate Big Data models, data storage techniques, data ingestion methods, and processing tools for scalable data management.	Level 3 : Apply
CO4	Analyze Big Data integration and processing pipelines, including data querying, aggregation, analytical operations, and workflow management tools.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Big Data: Big Data: Why and Where, Application and Challenges, Characteristics of Big Data and Dimensions of Scalability, The Six V, Data Science: Getting Value out of Big Data, Steps in the Data science process, Foundations for Big Data Systems and Programming, Distributed file systems.

Unit-II

Data Repositories and Big Data Platforms: RDBMS, NoSQL, Data Marts, Data Lakes, ETL, and Data Pipelines, Foundations of Big Data, Big Data Processing Tools, Modern Data Ecosystem, Key Players, Types of Data, Understanding Different Types of File Formats, Sources of Data Using Service Bindings.

Unit-III

Introduction to Big Data Modeling and Management: Data Storage, Data Quality, Data Operations, Data Ingestion, Scalability and Security Traditional DBMS and Big Data Management Systems, Real Life Applications, Data Model: Structure, Operations, Constraints, Types of Big Data Model.

Unit-IV

Big Data Integration and processing: Big Data Processing, Retrieving: Data Query and retrieval, Information Integration, Big Data Processing pipelines, Analytical operations, Aggregation operation, High level Operation, Tools and Systems: Big Data workflow Management.

Suggested Readings:

1. Big Data Analytics by Seema Acharya and Subhasini Chellappan, 2015, Wiley.
2. Intelligent Data Analysis by Michael Berthold and David J. Hand, 2007, Springer.
3. Big Data and Business Analytics by Jay Liebowitz, 2013, Auerbach Publications (CRC Press).
4. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop by Tom Plunkett and Mark Hornick, 2013, McGraw-Hill/Osborne Media (Oracle Press).
5. Mining of Massive Datasets by Anand Rajaraman and Jeffrey David Ullman, 2012, Cambridge University Press.
6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics by Bill Franks, 2012, John Wiley & Sons.
7. Making Sense of Data by Glenn J. Myatt, 2007, John Wiley & Sons.
8. Big Data Glossary by Pete Warden, 2011, O'Reilly Media.
9. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses by Michael Minelli, Michele Chambers, and Ambiga Dhiraj, 2013, Wiley Publications.
10. Big Data Analytics: Disruptive Technologies for Changing the Game by Arvind Sathi, 2012, MC Press.
11. Harness the Power of Big Data: The IBM Big Data Platform by Paul Zikopoulos, Dirk DeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, and David Corrigan, 2012, Tata McGraw-Hill Publications.

Useful Video Links:

Unit No.	Topics	Links	Source
Unit-I	Introduction to Big Data	https://youtu.be/rvJgArru8dI?si=WKCCX-VosNczfSzj	NPTEL (IIT Kanpur)
	Hadoop Distributed File System	https://youtu.be/0QIv4kk18Kg?si=FxQeaoBlepztA0XK	NPTEL (IIT Kanpur)
Unit-II	NoSQL	https://youtu.be/-s29jUAkg70?si=um-_zk8Xq6wipHEd	NPTEL (IIT Kanpur)
	Data Lakes	https://youtu.be/LxcH6z8TFpI?si=nDW2KBeKh9vGW_FE	YouTube (IBM Technology)
Unit-III	Introduction to Spark (Data operations and scalability)	https://youtu.be/-5yf4vCUsbQ?si=KET1yMZZxsdnCA2f	NPTEL (IIT Kanpur)
	Data Modeling	https://youtu.be/WSNqcYqByFk?si=2JWVZDxJN5jzIPAO	NPTEL (IIT Bombay)
Unit-IV	Big Data Pipeline	https://youtu.be/eDGa095uSyk?si=xYjXNotbYEf0YUgR	YouTube (StudyIQ IAS)
	Big Data Workflow Management System: OOZIE	https://youtu.be/cPLi8l_sehY?si=1lXn6RpHRrgdE7ub	YouTube (CEC)

<table>
<tr><td>Course code</td><td colspan="5">MPDS-006</td></tr>
<tr><td>Course title</td><td colspan="5">Project</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VIII</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To identify an engineering problem through literature review and clearly define project objectives.
To learn fundamental engineering principles to propose a feasible solution methodology.
To inculcate skills in project planning, preliminary design, and use of appropriate engineering tools.
To enhance teamwork, technical documentation, and presentation skills.</td></tr>
<tr><td>Assessment</td><td colspan="5">20 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">30 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

The students expected to take up a project under the guidance of teacher from the college. The Project must be based on **Data Science** problems, which can be extended up to the full semester. The students may be asked to work individually or in a group normally not more than three students in a group (if any large/ big projects occur then strength of students' can be increased as per guide supervision). Viva-voce must be based on the preliminary reports submitted by the students related to the project.

ANNEXURE 4.6(c)

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute
'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examination

For

Minor Degree

in

Artificial Intelligence and Machine Learning

Department of Computer Science and Engineering

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

Minor Degree
in
Artificial Intelligence and Machine Learning
Offered by the Department of Computer Science and Engineering

Artificial Intelligence and Machine Learning is interdisciplinary fields that integrate computer science, mathematics, statistics, and data analysis to develop intelligent systems capable of learning from data and making decisions with minimal human intervention. With the rapid advancement of digital technologies and the increasing adoption of automation, smart systems, and data-driven solutions across industries, government services, healthcare, finance, and research sectors, the demand for skilled professionals in Artificial Intelligence and Machine Learning has grown significantly. Recognizing their strategic importance in technological advancement and economic development, the government is actively promoting education, research, and innovation in AI and ML technologies. Therefore, universities and higher educational institutions are encouraged to incorporate Artificial Intelligence and Machine Learning into their academic programs.

In view of this, the Department of Computer Science and Engineering has introduced a Minor Degree in "**Artificial Intelligence and Machine Learning**" from the academic session **2026–27**. This program aims to enhance students' employability by providing specialized knowledge and practical skills in areas such as intelligent systems, machine learning algorithms, deep learning, natural language processing, and computer vision—domains that are often not extensively covered in the regular undergraduate curriculum. The program will enable students to develop strong expertise in Artificial Intelligence and Machine Learning and prepare them for diverse career opportunities in this rapidly evolving technological landscape.

This Minor Degree will require earning 20 credits. It will be an addition to the regular undergraduate program, implying that passing or failing it will not affect the results of the regular undergraduate program being pursued by the student. Upon successful completion of the course, a Minor Degree shall be awarded to the candidate. Students enrolled in B.Tech programs shall be eligible to pursue a Minor Degree, as outlined below:

Name of the Minor	B.Tech Program whose students are eligible to opt for Minor Degree
Artificial Intelligence and Machine Learning	All Branches except Computer Science and Engineering, CSE-Artificial Intelligence and Machine Learning and CSE-Data Science

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech Minor Degree in Artificial Intelligence and Machine Learning

w.e.f. 2026-27

Sr. No.	Sem	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in H
				Lecture (L)	Tutorial (T)	Lecture (L)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	MAI-001	Mathematics for AI	3	1	0	4	4	40	60		100	3
2	IV	CSE-210B	Artificial Intelligence	3	0	0	3	3	30	45		75	3
3	V	MAI-003	Python for AI	3	0	0	3	3	30	45		75	3
4	V	MAI-L003	Python for AI Lab	0	0	2	2	1	10		15	25	
5	VI	MAI-004	Machine Learning	3	0	0	3	3	30	45		75	3
6	VI	MAI-L004	Machine Learning Lab	0	0	2	2	1	10		15	25	
7	VII	MAI-005	Applied Artificial Intelligence	3	0	0	3	3	30	45		75	3
8	VIII	MP-006	Project	0	0	4	4	2	20		30	50	
Total Credits								**20**				**500**	

Note: To earn the required credits for the award of B. Tech Minor Degree students may choose either:

(i) To enroll in courses offered through NPTEL/MOOCs that must be equivalent to the prescribed courses in the approved scheme, subject to availability in any semester.

OR

(ii) To complete the prescribed courses in the same semester as offered by the department under the approved scheme and curriculum structure.

Course code	**MAI-001**				
Course title	**Mathematics for AI**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To introduce fundamental probability and statistical concepts required to model uncertainty in Artificial Intelligence. • To explain multivariate probability and statistical inference techniques used in data-driven AI systems. • To present information theory and optimization methods that underpin machine learning and deep learning algorithms. • To enable application of advanced mathematical tools to design, train, and evaluate Artificial Intelligence models.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental concepts of probability, random variables, statistical measures, and information theory used in Artificial Intelligence.	Level 1: Remember
CO2	Explain multivariate probability, statistical inference, and optimization principles relevant to AI and machine learning models.	Level 2: Understand
CO3	Apply probability distributions, estimation methods, and optimization techniques to solve AI-related computational problems.	Level 3 : Apply
CO4	Analyze AI models using information-theoretic measures, regularization techniques, and statistical evaluation to improve performance and generalization.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit–I

Probability Theory for Artificial Intelligence: Fundamentals of probability- sample space and events, axioms of probability, conditional probability, Bayes' theorem. Random variables- discrete and continuous cases, probability mass function, probability density function, and cumulative distribution function. Mathematical expectation concepts- mean, variance, standard deviation, moments, covariance, and correlation. Study of standard probability distributions- Bernoulli, Binomial, Poisson, Uniform, and Gaussian distributions, and their relevance in AI systems.

Unit–II

Multivariate Probability and Statistical Inference: Multivariate probability concepts- joint distributions, marginal, conditional distributions, and multivariate Gaussian distribution, Statistical inference fundamentals, sampling

techniques, estimation theory, and the bias–variance tradeoff. Parameter estimation methods- point estimation, Maximum Likelihood Estimation (MLE), Maximum A Posteriori (MAP) estimation, Hypothesis testing concepts- null and alternative hypotheses, confidence intervals, Type I and Type II errors.

Unit–III

Information Theory and Optimization Techniques for AI: Core information theory concepts: information content, entropy, joint and conditional entropy, cross entropy, and Kullback–Leibler (KL) divergence. Optimization fundamentals: formulation of optimization problems, convex sets, convex functions, and their properties. Unconstrained optimization techniques- gradient descent, batch, stochastic, and mini-batch gradient descent, momentum-based methods. Constrained optimization using Lagrange multipliers and Karush–Kuhn–Tucker (KKT) conditions, and regularization techniques including L1 (Lasso), L2 (Ridge), and Elastic Net.

Unit–IV

Advanced Mathematics and Applications in AI: Numerical optimization concepts including numerical stability, condition number, approximation errors, Graph theory fundamentals covering graphs and their types, adjacency matrix, degree matrix, graph Laplacian, Geometry in high-dimensional spaces- metrics, curse of dimensionality, manifold hypothesis, Mathematical foundations of deep learning-Universal Approximation Theorem, loss landscapes, over-parameterization, Applications of probability, statistics, optimization, information theory in AI- Bayesian inference, Naïve Bayes classifier, probabilistic models, training machine learning models, model evaluation, regularization, and avoiding overfitting.

Suggested Readings:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, 2019, Cambridge University Press.
2. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 2016, MIT Press.
3. Linear Algebra and Its Applications by Gilbert Strang, 2016, Cengage Learning.
4. Probability, Random Variables and Stochastic Processes by Athanasios Papoulis and S. Unnikrishna Pillai, 2002, McGraw-Hill Education.
5. Convex Optimization by Stephen Boyd and Lieven Vandenberghe, 2004, Cambridge University Press.

Useful Video Links:

Unit No.	Topics	Links	Source
Unit-I	Sample space, events, axioms	https://youtu.be/POv_YgCqAv8?si=c5bqoYWFCuU2c7mx	NPEL(IIT Kanpur)
	Random variables, PMF, PDF, CDF	https://www.youtube.com/playlist?list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE	NPTEL(IIT Tirupati)
	Moments	https://youtu.be/vNNLvowQqoU?si=46OGZxJWxSUYu392	NPTEL(IIT Kharagpur)
Unit-II	Multivariate Gaussian	https://youtu.be/XbA9CmYAfVk?si=d4bNUD3Xuy1eve5q	NPTEL(IIT Madras)
	Bias–variance tradeoff	https://youtu.be/1_8zmpy_Q7w?si=jmOB5OfbujSkvch_	NPTEL(IIT Madras)
	Type I & II errors	https://youtu.be/qqVWgxWn2d4?si=bG4Nq_BVclYT1d8e	NPTEL(IIT Madras)
Unit-III	Convex sets & functions	https://youtu.be/KZPq0bGbqDY?si=ve6tOWLZZmJsHTp2	NPTEL(IIT Bombay)
	Elastic Net, L1	https://youtu.be/sdoSkZRrBZI?si=hf46X2Kj-zb1zilf	NPTEL(IISC Bengaluru)
Unit-IV	Numerical stability, condition number	https://youtu.be/TWAN_T66Cps?si=hLJFP0ZhYR_9djlv	NPTEL (IIT Roorkee)
	Graph Theory	https://youtube.com/playlist?list=PLEAYkSg4uSQ2fXcfrTGZdPuTmv98bnFY5&si=F0ujo6ibJCzlCQYf	NPTEL (IISER Pune)
	Bayesian inference, Naïve Bayes	https://youtu.be/1B_lrrEo5ds?si=vOBgekF_1RikDYwu	NPTEL(IIT Madras)

Course code	**CSE-210B**				
Course title	**Artificial Intelligence**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV (Common with B. Tech. CSE/AI&ML/DS 4th Semester)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts, history, and problem-solving nature of artificial intelligence. • To provide an understanding of core AI techniques for search, knowledge representation, reasoning, planning, and learning. • To develop the ability to apply appropriate AI methods to solve representative computational problems. • To familiarize students with modern AI systems, expert systems, neural networks, and emerging trends in artificial intelligence.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental concepts of artificial intelligence, problem characteristics, knowledge representation, learning paradigms, and current AI trends.	Level 1: Remember
CO2	Explain search strategies, knowledge representation schemes, reasoning under uncertainty, planning approaches, and learning methods used in artificial intelligence.	Level 2: Understand
CO3	Apply appropriate AI techniques such as search algorithms, logical reasoning, probabilistic methods, and learning models to solve representative AI problems.	Level 3 : Apply
CO4	Analyze AI problems to select suitable problem-solving, reasoning, planning, or learning approaches and evaluate their effectiveness.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Definition of AI, History of AI, nature of AI problems, examples of AI problems. **Problem solving by search:** Uninformed Search: Depth First Search (DFS), Breadth First Search(BFS). Informed Search: Best First Search, A*. Local Search: Hill Climbing. Problem Reduction Search: AO*. Population Based Search: Ant Colony Optimization, Genetic Algorithm. Game Playing: MinMax Algorithm, Alpha-Beta Pruning.

Unit-II

Knowledge Representation: Types of Knowledge, Knowledge Representation Techniques/schemes: Propositional Logic, Predicate Logic, Semantic nets, Frames, Knowledge representation issues, Rule based systems.

Unit-III

Reasoning under Uncertainty: Basics of Probability Theory, Probabilistic Reasoning, Bayesian Reasoning, Dempster-Shafer Theory.
Planning: Introduction to Planning, Representation of Planning, Partial-order Planning.

Unit-IV

Learning: Introduction to Learning, Types of Learning: Learning by Induction, Rote Learning, Symbol Based Learning, Identification Trees, Explanation Based Learning, Transformational Analogy, Introduction to Neural Networks, Expert Systems, and Current trends in Artificial Intelligence.

Suggested Readings:

1. Artificial Intelligence: A Modern Approach, Third Edition by Stuart Russell and Peter Norvig, 2010, Pearson Education.
2. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009.
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., 2010.
4. Artificial intelligence, Patrick Henry Winston, 1992, Addition Wesley.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to AI	https://youtu.be/iF1tOCEXLXY
	DFS, BFS	https://youtu.be/TMLyKcBtHuo
	Hill Climbing	https://youtu.be/ZOvRZ7UJMjk
	A* Algorithm	https://youtu.be/yMcZvZayJUA
Unit-II	Propositional Logic	https://youtu.be/5fZ_RnhvGMQ
	Semantic Nets	https://youtu.be/RTmafl2rzEw
	Rule based System	https://youtu.be/6kRYg1QVcWo
Unit-III	Bayesian Reasoning	https://youtu.be/cMN6ykIYF_U
	Probability Theory	https://nptel.ac.in/courses/117105085
	Partial-order Planning	https://www.youtube.com/watch?v=kyCibTQQQBE
Unit-IV	Introduction to Neural Networks	https://www.youtube.com/watch?v=QlhHqMnd9Wo
	Expert Systems	https://www.youtube.com/watch?v=nE5c5w4aizU

Course code	**MAI-003**				
Course title	**Python for AI**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals of Python programming, including syntax, data types, control structures, and file handling. • To develop structured programming skills using Python data structures, functions, and recursion. • To familiarize students with numerical and data manipulation libraries such as NumPy and Pandas for handling real-world data. • To enable students to visualize and interpret data effectively using Matplotlib for exploratory and analytical purposes.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define core Python programming concepts, data structures, and library functionalities.	Level 1: Remember
CO2	Explain the working principles of Python programs, NumPy arrays, Pandas data structures, and visualization components.	Level 2: Understand
CO3	Apply Python, NumPy, Pandas, and Matplotlib to perform data processing, analysis, and visualization tasks.	Level 3 : Apply
CO4	Analyze datasets by selecting appropriate data manipulation techniques and visualization methods to derive insights.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Installing Python; basic syntax, interactive shell, editing, saving, and running a script; data types; variables, assignments; numerical types; arithmetic operators and expressions; Loops and selection statements, Control statements String manipulations: subscript operator, indexing, slicing a string; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file.

Unit-II

Lists, Tuple, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; Tuple: creating tuples, accessing elements, tuple immutability, operations, tuple methods,

tuples vs. lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries. Hiding redundancy, complexity; arguments and return values; Program structure and design. Recursive functions.

Unit-III

Introduction to NumPy: NumPy arrays, Array Indexing and Slicing, Array Operations, Array Manipulation, Linear Algebra with NumPy, Random Number Generation and Statistics.
Introduction to Pandas: Pandas Series, Pandas Data Frames, Data Frame Indexing and Selection, Data Cleaning and Pre-processing, Data Manipulation, Group by Operations, Merging, Joining, and Concatenating Data Frames, Input/output Operations.

Unit-IV

Matplotlib: Overview of Data Visualization in Python, What is Matplotlib? Features and Advantages, Matplotlib Architecture, Installation and Setup, Importing Matplotlib, Basic plotting concepts, Statistical & Categorical Plots (Bar Charts (Vertical and Horizontal, Histograms, Pie Charts, Scatter Plots, Error Bars), Advanced Plot Customization, Plotting with NumPy arrays, Plotting with Pandas DataFrames, Time series visualization, Handling large datasets, 3D Plotting, Applications of Matplotlib.

Suggested Readings:

1. Fundamentals of Python: First Programs by Kenneth Lambert, Course Technology, Cengage Learning, 2012.
2. Introduction to Computer Science using Python: A Computational Problem-Solving by Dierbach, C. Focus, John Wiley & Sons, 2012.
3. Python – The Complete Reference by Brown, M. C., McGraw Hill Education.
4. Core Python Programming by Rao, R. N., Dream Tech Press.
5. Python Programming: Using Problem Solving Approach by Thareja, R., Oxford University Press.
6. Python Programming by Sridhar, S., Indumathi, J., & Hariharan, V. M., Pearson Education.
7. Python for Data Analysis by Wes McKinney, 3rd Edition, O'Reilly Media, 2022.
8. Python Data Science Handbook by Jake VanderPlas, O'Reilly Media.

Useful Video Links:

Unit No.	Topics	Links	Source
Unit-I	Variables and Input Statement	https://youtu.be/ruQb8jzkGyQ	NPTEL(IIT Madras)
	Data Types, Operators and Expressions	https://youtu.be/8n4MbjuDBu4	NPTEL(IIT Madras)
	Introduction to for loop	https://youtu.be/lvXuQ_x7EsI	NPTEL(IIT Madras)
	Introduction to while loop	https://youtu.be/KTvVNN7ia8o	NPTEL(IIT Madras)
	Reading and Writing to a File	https://www.youtube.com/watch?v=rYLJaAdgLhI	NPTEL(IIT Madras)
	Creating and reading a formatted file	https://www.youtube.com/watch?v=NBTSDtBy5bs	NPTEL(IIT Roorkee)
Unit-II	List operators	https://youtu.be/jMShssechMI	NPTEL(IIT Madras)
	Searching and sorting lists	https://youtu.be/4OxBvBXon5w	NPTEL(IIT Delhi)
	Tuples	https://youtu.be/mzx74TdGYbg	NPTEL(IIT Madras)
	Dictionary literals, adding and removing elements	https://youtu.be/Aj7PwBI99A4	NPTEL(IIT Ropar)
	Recursive functions	https://youtu.be/Uo7RyqJaaRQ	NPTEL(IIT Ropar)
Unit-III	NumPy	https://youtu.be/pEyizxN3K84?si=mMhOKJ5eI-sEwuSG	NPTEL(IIT Madras)
	Pandas	https://youtu.be/V-PozDJ7c1A?si=4o2rCAP_hJuUugE8	NPTEL(IIT Madras)
Unit-IV	Matplotlib	https://youtu.be/eFByJkA3ti4?si=sm1gY8G0rCRF6c6k	NPTEL(IIT Madras)
	Advanced Plot Customization	https://youtu.be/YxchP5MziC4?si=VqvKBbar-gT9EZxR	YouTube (Geo-Python)
	3D Plotting	https://youtu.be/7e3BGIXwQvo?si=5HK1zkvL5XwwR-bi	You Tube (Finxter AI Nuggets)

Course Code	**MAI-L003**				
Course Title	**Python for AI Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To enable students to implement Python programs using core language constructs and file handling. ● To develop the ability to apply data structures and modular programming for problem solving. ● To provide hands-on experience with NumPy and Pandas for data manipulation and analysis. ● To train students in visualizing data effectively using Matplotlib for analytical insights.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the syntax, control structures, string operations, and file handling mechanisms of Python through guided laboratory exercises.	Level 2: Understand
CO2	Develop Python programs using lists, tuples, dictionaries, and functions (including recursion) to solve structured computational problems.	Level 3: Apply
CO3	Apply NumPy and Pandas libraries to perform array-based computation, data cleaning, manipulation, and basic statistical analysis on real-world datasets.	Level 3: Apply
CO4	Analyze datasets and interpret results by designing appropriate 2D/3D visualizations using Matplotlib with customized and optimized plots.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Study the basic features and installation of Python.	CO1
2	Write a Python program to compute the G.C.D. of two numbers.	CO1
3	Write a Python program to find the square root of a number.	CO1
4	Write a Python program to find the power of a number.	CO1
5	Write a Python program to find the maximum in a list of numbers.	CO2
6	Write a Python program to implement linear search and binary search in a list.	CO2

7	Write a Python program to sort the element using selection sort, insertion sort and merge sort	CO2
8	Write a Python program to compute first “n” prime numbers	CO2
9	Write a Python program to find the most frequent word in a text file.	CO2
10	Write a Python program to create and perform operations on arrays using NumPy	CO3
11	Write a Python program to apply Pandas for manipulating a dataset and performing grouped statistical operations.	CO3
12	Write a program in Python to create bar charts, histograms, pie charts, and scatter plots.	CO4
13	Write a program in Python to plot data using NumPy arrays.	CO4
14	Write a program in Python to visualize data using Pandas DataFrame.	CO4
15	Write a program in Python to create a 3D plot using Matplotlib.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links

Experiment Name	Virtual Lab Link	Source
Loops in Python	https://python-iitk.vlabs.ac.in/exp/loops/	Virtual Labs
File Handling in Python	https://python-iitk.vlabs.ac.in/exp/file-operators/index.html	Virtual Labs
List, Dictionary in Python	http://python-iiith.vlabs.ac.in/exp/complex-datatypes/index.html	Virtual Labs

<table>
<tr><td>Course code</td><td colspan="5">MAI-004</td></tr>
<tr><td>Course title</td><td colspan="5">Machine Learning</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To introduce the fundamental concepts, terminology, and evolution of Machine Learning along with its need and applications.
• To familiarize students with the Machine Learning life cycle, data representation methods, and preprocessing techniques.
• To develop an understanding of supervised and unsupervised learning paradigms and commonly used Machine Learning algorithms.
• To enable students to analyze learning outcomes using appropriate performance evaluation metrics and error measures.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts, terminology, and classifications of Machine Learning.	Level 1: Remember
CO2	Explain the Machine Learning life cycle, data representation methods, and working principles of learning algorithms.	Level 2: Understand
CO3	Apply suitable preprocessing techniques and Machine Learning algorithms to basic real-world datasets.	Level 3 : Apply
CO4	Analyze Machine Learning models by comparing algorithms and interpreting performance metrics.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction Machine Learning: Definition, History, Need, Features, Block diagrammatic representation of learning machines, Classification of Machine Learning: Supervised learning, Unsupervised learning, Reinforcement Learning, Machine Learning life cycle, Applications of Machine Learning.

Unit-II

Dimensionality Reduction Dimensionality reduction: Definition, Row vector and Column vector, how to represent a dataset, how to represent a dataset as a Matrix, Data preprocessing in Machine Learning: Feature Normalization, Mean of a data matrix, Column Standardization, Co-variance of a Data Matrix, Principal Component Analysis for Dimensionality reduction..

Unit-III

Supervised Learning Supervised Learning: Definition, how it works. Types of Supervised learning algorithms k-Nearest Neighbours, Naïve Bayes, Decision Trees, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines.

Unit-IV

Unsupervised Learning Unsupervised Learning: Clustering: K-means. Ensemble Methods: Boosting, Bagging, Random Forests. Evaluation: Performance measurement of models in terms of accuracy, confusion matrix, precision & recall, F1-score, receiver Operating Characteristic Curve (ROC) curve and AUC, Median absolute deviation (MAD), Distribution of errors

Suggested Readings:

1. Introduction to Machine Learning by Ethem Alpaydin, Prentice Hall of India, 2006.
2. The Elements of Statistical Learning: Data Mining, Inference, and Prediction (2nd Edition) by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, Springer, 2009.
3. Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer, 2010.
4. Pattern Classification by Richard O. Duda, Peter E. Hart, and David G. Stork, John Wiley & Sons, 2012.
5. Neural Networks and Learning Machines by Simon O. Haykin, Pearson Education, 2016.

Useful Video Links:

Unit No.	Topics	Links	Source
Unit-I	Definition, History, Features of ML	https://youtu.be/oX0sfqHsGMI?si=HmvFRlnXHS2mxsdt	NPTEL (IIIT-Delhi)
	Types of ML	https://youtu.be/fC7V8QsPBec?si=C6SFLiFetMmzjhv1	NPTEL (IIT-Madras)
Unit-II	Principal Component Analysis	https://youtu.be/hkCT-6KJAK0?si=REHs_XXvLh4NS4OJ	NPTEL(IIT Kharagpur)
	Dimensionality Reduction	https://youtu.be/0P9gUYQ38cI?si=gKuCjKu7iIUUJjZB	NPTEL(IISc Bangalore
Unit-III	Supervised Learning	https://youtu.be/OTAR0kT1swg?si=-uIrst7xSFi_0Gk-	NPTEL (IIT-Madras)
	Support Vector Machines	https://youtu.be/JUR6m7-jXaY?si=mnqq8YOO_k79zU9G	NPTEL (IIT-Madras)
Unit-IV	Bagging	https://youtu.be/enD2BvWSukI?si=5XRVXWkqHcMUqOkr	NPTEL (IIT-Madras)
	Boosting	https://youtu.be/i4OvvmRIz4A?si=-LiawZoaMyH5rZry	NPTEL (IIT-Madras)

<table>
<tr><td>Course Code</td><td colspan="5">MAI-L004</td></tr>
<tr><td>Course Title</td><td colspan="5">Machine Learning Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide hands-on exposure to fundamental concepts and workflow of Machine Learning.
To enable students to preprocess, represent, and transform datasets suitable for Machine Learning tasks.
To develop the ability to implement supervised and unsupervised Machine Learning algorithms using Python.
To train students in comparing, and analyzing Machine Learning models using appropriate performance metrics.</td></tr>
<tr><td>Assessment</td><td colspan="5">10 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">15 Marks</td></tr>
<tr><td>Total</td><td colspan="5">25 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the basic concepts, workflow, and types of Machine Learning through guided laboratory demonstrations and experiments.	Level 2: Understand
CO2	Implement data preprocessing techniques and dimensionality reduction methods such as PCA for Machine Learning tasks.	Level 3: Apply
CO3	Apply supervised learning algorithms to build predictive models using Python-based Machine Learning libraries.	Level 3: Apply
CO4	Analyze and evaluate Machine Learning models using appropriate performance metrics and error distribution techniques.	Level 4: Analyze

List of Experiments

Sr. No.	Content	COs
1	Study the basic concepts, applications, and life cycle of Machine Learning using Python libraries.	CO1
2	Write a Python program to represent a dataset using row vectors, column vectors, and matrix representation.	CO2
3	Write a Python program to perform feature normalization and column standardization on a dataset.	CO2
4	Write a Python program to compute mean, covariance matrix, and visualize data variance.	CO2

5	Write a Python program to implement Principal Component Analysis (PCA) for dimensionality reduction.	CO2
6	Write a Python program to implement k-Nearest Neighbours (k-NN) classification algorithm.	CO3
7	Write a Python program to implement Naïve Bayes classifier for a given dataset.	CO3
8	Write a Python program to implement Decision Tree classification and visualize the tree.	CO3
9	Write a Python program to implement Linear Regression and Logistic Regression models.	CO3
10	Write a Python program to implement Support Vector Machine (SVM) for classification.	CO3
11	Write a Python program to implement K-Means clustering and visualize clusters.	CO3
12	Write a Python program to implement ensemble techniques such as Bagging, Boosting, and Random Forests.	CO3
13	Write a Python program to evaluate classification models using confusion matrix, accuracy, precision, recall, and F1-score.	CO4
14	Write a Python program to plot ROC curve and compute AUC for a classification model.	CO4
15	Write a Python program to analyze model errors using MAD and error distribution plots.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**	**Source**
Dataset Representation using rows and columns	https://colab.research.google.com/drive/186nx47CNlqGDEkpshA04dwT6lq9gQ9Q5?usp=sharing	Google Colab
Decion Tree Classification	https://colab.research.google.com/drive/1wJBt5QZFRx3cjXtyywvvwDuyZzs1xj9k?usp=sharing	Google Colab
K-Means clustering.ipynb	https://colab.research.google.com/drive/1Yb1fMvzu1trKUeXVAf9XV00geS-yLyUO?usp=sharing	Google Colab

Course code	**MAI-005**				
Course title	**Applied Artificial Intelligence**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VII**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce core concepts and applications of Applied Artificial Intelligence. • To explain methods for processing text, images, temporal data, and user preferences. • To apply AI models for real-world problem solving. • To analyze the effectiveness and challenges of AI techniques.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental concepts and challenges in Applied Artificial Intelligence.	Level 1: Remember
CO2	Explain the principles and techniques used in NLP, Computer Vision, Time Series, and Recommendation Systems.	Level 2: Understand
CO3	Apply suitable AI models to text, image, forecasting, and recommendation problems.	Level 3 : Apply
CO4	Analyze AI solutions based on performance, suitability, and limitations.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 9 parts of 1 mark each from all units and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to NLP: Overview, scope, and evolution of Natural Language Processing, NLP in Artificial Intelligence, Challenges in NLP.
Linguistic Foundations for NLP: Lexical Analysis, Morphological Analysis, Syntactic Analysis (Parsing), Semantic Analysis, Discourse Analysis, Pragmatic Analysis, Text Processing and Normalization, Introduction to NLP Tools and Libraries.

Unit-II

Introduction to Computer Vision: Overview of Computer Vision and Image Processing, Applications of Computer Vision.
Image Representation: Digital image representation, Image types and formats, Color models (RGB, Grayscale, HSV), Image Preprocessing and Enhancement, Feature Extraction and Detection, Image Classification and Recognition.

Unit-III

Introduction to Time Series: Definition and characteristics of time series data, Applications of time series analysis, Components of Time Series, Time Series Visualization and Preprocessing.
Classical Time Series Models: Auto-Regressive (AR) models, Moving Average (MA) models, ARIMA models, Seasonal ARIMA (SARIMA).
Forecasting Technique: Model selection, Forecast accuracy measures, Applications of time series forecasting.

Unit-IV

Recommendation Systems: Introduction to Recommendation Systems, Need and importance of recommendation systems, Real-world motivation and examples.
Types of Recommendation Systems: Content-Based Recommendation Systems, Collaborative Filtering, Knowledge-Based Systems .
Recommendation Techniques: User-based and Item-based Collaborative Filtering, Matrix Factorization techniques, Hybrid Recommendation Systems, Evaluation and Challenges.

Suggested Readings:

1. Computer Vision: Algorithms and Applications by Richard Szeliski, 2011.
2. Natural Language Understanding by James Allen, 1994.
3. Introduction to Time Series and Forecasting by Peter J. Brockwell & Richard A. Davis, 2016.
4. Forecasting: Principles and Practice by Rob J. Hyndman & George Athanasopoulos, 2021.
5. Recommender Systems Handbook by Francesco Ricci, Lior Rokach & Bracha Shapira, 2022.
6. Recommender Systems: An Introduction by Dietmar Jannach et al., 2011.
7. Introduction to Natural Language Processing by Jacob Eisenstein, 2019.

Useful Video Links

Unit No.	Topics	Links	Source
Unit-I	Introduction to NLP	https://youtu.be/XRpJMxLaLeA?si=DCvumrsBSVhGEViG	NPTEL (IIT Bengaluru)
	Text Processing	https://youtu.be/7ok49o24SDw?si=QU0TmC5422oiz6us	NPTEL (IIT Kharagpur)
Unit-II	Image Representation	https://youtu.be/a4yd0Au8QLg?si=R4mqSUssVHgNG6Mz	NPTEL (IIT Delhi)
	Colour Image Processing	https://www.youtube.com/watch?v=svgZodJgKaU	NPTEL (IIT Kharagpur)
Unit-III	Introduction to Time Series	https://youtu.be/bc_7XnEt7TU?si=viOrGSvAS5kAZKNR	NPTEL (IIT Madras)
	ARIMA Models	https://www.youtube.com/watch?v=dXND1OEBABI	YouTube (Aric LaBarr)
Unit-IV	Collaborative Filtering	https://youtu.be/h9gpufJFF-0?si=wo_FnVDL19wSqSVA	Stanford University
	Introduction to Recommendation Systems	https://youtu.be/1JRrCEgiyHM?si=WPTsJajCQDm_qgye	Stanford University

<table>
<tr><td>Course code</td><td colspan="5">MP-006</td></tr>
<tr><td>Course title</td><td colspan="5">Project</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VIII</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To identify an engineering problem through literature review and clearly define project objectives.
To learn fundamental engineering principles to propose a feasible solution methodology.
To inculcate skills in project planning, preliminary design, and use of appropriate engineering tools.
To enhance teamwork, technical documentation, and presentation skills.</td></tr>
<tr><td>Assessment</td><td colspan="5">20 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">30 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

The students expected to take up a project under the guidance of teacher from the college. The Project must be based on **Artificial Intelligence and Machine Learning** problems, which can be extended up to the full semester. The students may be asked to work individually or in a group normally not more than three students in a group (if any large/ big projects occur then strength of students' can be increased as per guide supervision). Viva-voce must be based on the preliminary reports submitted by the students related to the project.

Annexure-4.7

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

(An Autonomous Institute under Maharshi Dayanand University, Rohtak and Accredited with NAAC 'A' Grade)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Panel of Examiners for Theory, Practical/Dissertation/Project/Seminar Examinations of B.Tech. (CSE, AIML, and DS) and M.Tech. (CSE and CFIS) Programmes for the Academic Session 2026–2027

Sr. No	Name of Examiner	Designation	Affiliation / Organization	Contact No.	Email id
1	Dr. Yudhvir Singh	Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9315517965	dr.yudhvirs@gmail.com
2	Dr. Rahul Rishi	Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9812175085	rahulrishi@rediffmail.com
3	Dr. Nasib Singh Gill	Professor	Department of Computer Science & Application, MDU, Rohtak	9050805136	nasib.gill@mdurohtak.ac.in
4	Dr. Yogesh Chhaba	Professor	Department of Computer Science & Engineering, Guru Jambeshwar University Science & Technology, Hisar	9416080020	yogeshchaba@yahoo.com
5	Dr. Ashutosh Dixit	Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9873356911	dixit.ashutosh@jcboseust.ac.in
6	Dr. V. P. Vishwakarma	Professor	University School of Information, Communication & Technology, GGSIPU, Dwarka, New Delhi	9891307464	virendravishwa@gmail.com
7	Dr. Amit Prakash Singh	Professor	University School of Information, Communication & Technology, GGSIPU, Dwarka, New Delhi	9899166168	amit@ipu.ac.in
8	Dr. Namita Gupta	Professor	Department of Computer Science & Engineering, Maharaja, Agrasen Institute of Technology (MAIT), Rohini, Delhi	9811257754	namita@mait.ac.in
9	Dr. Parvinder Singh	Professor	Department of Computer Science & Engineering, DCRUST, Murthal, Sonipat	9416108322	parvindersingh.cse@dcrustm.org
10	Dr. Dinesh Singh	Professor	Department of Computer Science & Engineering, DCRUST, Murthal, Sonipat	9466368273	dineshsingh.cse@dcrustm.org
11	Dr. Manoj Kumar	Professor	Department of Computer Science & Engineering, DTU, Delhi	9013057758	mkumarg@dce.ac.in
12	Dr. Vinod Kumar	Professor	Department of Computer Science & Engineering, DTU, Delhi	9811605325	vinod_k@dtu.ac.in
13	Dr. R. K. Agrawal	Professor	School of Computer & Systems Sciences, JNU, New Delhi	09810115033	rka@mail.jnu.ac.in
14	Dr. Shailender Verma	Professor	Department of Computer Science & Engineering, DTU, Delhi	9810566485	shailenderkumar@dce.ac.in
15	Dr. Gopal Singh	Associate Professor	Department of Computer Science & Application, MDU, Rohtak	9896882065	gsbhoria.dcsa@mdurohtak.ac.in

16	Dr. Jyoti	Associate Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9910341139	jyotiverma@jcboseust.ac.in
17	Dr. Vikas Siwach	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416630655	singhvikashuiet@gmail.com
18	Dr. Harkesh Sehrawat	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416486828	sehrawat_harkesh@mduroht ak.ac.in
19	Dr. Kamna Solanki	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	8053419626	kamna.mduro htak@gmail.c om
20	Dr. Preeti Gulia	Associate Professor	Department of Computer Science & Application, MDU, Rohtak	9467485548	preeti@mduro htak.ac.in
21	Dr. Pramod	Associate Professor	Department of Computer Science & Engineering, GITAM, Kablana	7419110008	parmod.cse@g angainstitute.c om
22	Dr. Sanjeev Indora	Associate Professor	Department of Computer Science & Engineering, DCRUST, Murthal	9466256121	sanjeevindora. cse@dcrustm. org
23	Dr. Kamaldeep	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416952504	kamalmintwal @gmail.com
24	Dr. Yogesh Kumar	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9050607001	Yogs_crsce@ yahoo.com
25	Dr. Bal Kishan	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9416517453	balkishan@m durohtak.ac.in
26	Dr. Sunita Dhingra	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9255100092	sunitadhingra mdu@rediff.c om
27	Dr. Pooja Mittal	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9468110000	pooja@mduro htak.ac.in
28	Dr. Priti Sharma	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	8708395855	priti@mduroht ak.ac.in
29	Dr. Karan Singh	Assistant Professor	School of Computer & Systems Sciences, JNU, New Delhi	9971037951	karan@mail.jn u.ac.in
30	Dr. Karan Verma	Assistant Professor	Department of Computer Science & Engineering, NIT Delhi		karanverma@ nitdelhi.ac.in.
31	Dr. Manisha Manjul	Assistant Professor	Department of Computer Science & Engineering, G.B. Pant Govt. Engineering College (DSEU), New Delhi	8826367541	manisha.manj ul@dseu.ac.in
32	Dr. Harish Kumar	Assistant Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9911911782	htanwar@jcbo seust.ac.in
33	Dr. Neeetu Verma	Assistant Professor	Department of Computer Science & Engineering, DCRUST, Murthal	8708445914	neetuverma.cs e@dcrustm.or g
34	Dr. Dheer Dhwaj Barak	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9315809071	dheer.rp.uiet@ mdurohtak.ac.i n
35	Dr. Priyanka Rani	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	7988501899	priyachhillar3 0@gmail.com
36	Dr. Divya	Assistant Professor	Vivekananda Institute of Professional Studies-Technical Campus, GGSIPU, Delhi	9968362010	er.divya7@gm ail.com

37	Dr. Sudesh Yadav	Assistant Professor	Department of Computer Science & Engineering, Govt. PG College Ateli	6467652778	yadavsudesh01@gmail.com
38	Dr. Shweta Rani	Assistant Professor	Department of Computer Science & Engineering, Jaypee Institute of Information Technology (JIIT), Noida	7838423088	shweta.rani@jiit.ac.in
39	Mr. Rahul	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	8059413612	rahul.cse@gangainstitute.com
40	Ms. Upasna	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	8295200669	upasna.cse@gangainstitute.com
41	Mr. Jitender Kumar	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	9996439970	jsaini.ymca@gmail.com
42	Mr. Dheeraj Kumar Sahni	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9034882111	dheerajsahni91@gmail.com
43	Dr. Dheer Dhwaj Barak	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9315809071	dheer.rp.uiet@mdurohtak.ac.in
44	Ms. Ritu Kadyan	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	7065217140	ritukadyan.cse@gangainstitute.com
45	Ms. Nisha	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	8059175375	nisha.cse@gangainstitute.com
46	Mr. Jitender Singh	Assistant Professor	Department of Computer Science &Applications, GITAM, Kablana	9891599903	hod.ca@gangainstitute.com
47	Ms. Meenu Sharma	Assistant Professor	Department of Computer Science &Applications, GITAM, Kablana	9050237645	minu.cse@gangainstitute.com
48	Dr. Pankaj Lathar	Director	Delhi Skill and Entrepreneurship University, New Delhi	9891640788	pankaj.lathar@desu.ac.in
49	Dr. Yogesh Kumar	Associate Professor	Department of Computer Science & Engineering, GD Goenka University, Gurugram	9466973730	yogesh.kumar1@gdgu.org
50	Dr. Vinod Kumar Saroha	Associate Professor	Department of Computer Science & Engineering, Bhagat Phool Singh Mahila Viswavidyalaya, Khanpur Kalan, Sonipat	9416427656	vinod.saroha@bpswomenuniversity.ac.in
51	Dr. Anil	Professor	Department of Computer Science & Application, GITAM, Kablana	9466350772	hod.ca@gangaistitute.com
52	Dr. Sandeep Sharma	Associate Professor	HOD-AIML/DS, St. Andrew Institute of Technology and Management, Farukhnagar	9896694979	hod.aiml@saitm.ac.in
53	Mikanshu Rani	Assistant Professor	Department of Emerging Technology, Chandigarh Engineering College, CGC-Landran	9467346259	Mikanshu6406@gmail.com
54	Dr. Neebu Gupta	Professor	Chandigarh University	9050272255	Menu.e9406@cumail.in
55	Dr. Nishant Anand	Associate Professor	IMS Engineering College Ghaziabad	9812273967	drnishantanand@gmail.com
56	Dr. Sandhya Tarwana	Assistant Professor	Vivekananda Institute of Professional Studies-Technical Campus, GGSIPU, Delhi		sandhya Tarwani@vips.edu

57	Dr. Sonakshi Vij	Assistant Professor	Vivekananda Institute of Professional Studies-Technical Campus, GGSIPU, Delhi		Sonakshi.vij@vips.edu

Note: For Dissertation / Project (PG) Examination Faculty should posses minimum Ph.D. Degree or not below the rank of Associate Professor. In case of non availability of examiners from above said list, Director of the institute can nominate the expert on his discretion. In addition to the above faculties from institute of National Importance / Eminence viz. IIT's, NIT's, IIIT's, State or Central University and industry personal not below the Manager rank are also eligible with the permission of Director of the Institute.

Annexure AC / 5.17

Ganga Institute of Technology and Management, Kablana
(An Autonomous Institute under Maharshi Dayanand University, Rohtak)

Minutes of 4th Meeting of Board of Studies of Civil Engg. Department held on 06.06.2026

4th Meeting of the Board of Studies (BOS) of the Civil Engineering Department was held on 06.06.2026 at 11:45 A.M. in the Conference Hall of the Institute.

The following members were present in the meeting:

Sr. No.	Name of the Member	Affiliation / Organization	Designation within Board of Studies
1	Ms. Sheela Malik	Chairperson	HOD & Assistant Professor, Civil, GITAM, Kablana
2	Dr. Isha Verma	Member	Subject Expert (Assistant Professor, Civil, UIET, MDU Rohtak), University Nominee
3	Dr. Vikas Garg	Member	Subject Expert (Professor, Civil, Central University Mahendergarh), Outside Parent University
4	Dr. Mahesh Pal	Member	Subject Expert (Professor, Civil, NIT Kurukshetra) Outside Parent University
5	Mr. Aseem Harit	Member	Assistant Professor, Mathematics, GITAM Kablana
6	Mr. Prince	Member	Assistant Professor, Civil, GITAM Kablana
7	Mr. Abhishek Ojha	Member	Assistant Professor, Civil, GITAM Kablana
8	Mr. Mukesh	Member	Assistant Professor, Civil, GITAM Kablana
9	Ms. Anju	Member	Assistant Professor, Civil, GITAM Kablana
10	Ms. Muskan	Member	Assistant Professor, Civil, GITAM Kablana
11	Mr. Ankit	Member	Assistant Professor, Civil, GITAM Kablana
12	Mr. Bhupender Malik	Member	Assistant Professor, Civil, GITAM Kablana
13	Mr. Sachin Dalal	Member	Assistant Professor, Civil, GITAM Kablana
14	Mr. Himalaya	Member	Assistant Professor, Civil, GITAM Kablana
15	Mr. Akhilesh	Member	Assistant Professor, Civil, GITAM Kablana
16	Ms. Jyoti	Member	Assistant Professor, Civil, GITAM Kablana
17	Ms. Pinki	Member	Assistant Professor, Civil, GITAM Kablana
18	Ms. Nirmala	Member	Assistant Professor, Civil, GITAM Kablana
19	Dr. Tinku Biswas	Member	Industry/ Corporate Sector

Malik

GANGA INSTITUTE OF TECHNOLOGY & MANAGEMENT, KABLANA
HOD-CIVIL

20	Mr. Aman Dalal	Member	Alumni

At the outset, the Chairperson welcomed all the members present in the meeting. The agenda items, as circulated earlier, were taken up for discussion.

The further proceeding is as under: -

Item 4.1 **Confirmation of the Minutes of the 3rd Meeting of the Board of Studies of Civil Engineering Department held on 23.12.2025.**

To confirm the minutes of the 3rd Meeting of the Board of Studies of Civil Engineering Department held on 23.12.2025 **(Annexure–4.1, Pages 1–3 already circulated).**

RESOLVED THAT THE MINUTES OF THE 3RD MEETING OF THE BOARD OF STUDIES OF CIVIL ENGINEERING DEPARTMENT HELD ON 23.12.2025 (ANNEXURE–4.1, PAGES 1–3 ALREADY CIRCULATED) BE CONFIRMED.

Item 4.2 **Follow-up Action Report on the Decisions Taken in the 3rd BOS Meeting of Civil Engineering Department held on 23.12.2025.**

To note the follow-up action on the decisions taken in the 3rd Meeting of the Board of Studies of Civil Engineering Department held on 23.12.2025 **(Annexure–4.2, Pages 4–5 already circulated).**

RESOLVED THAT THE FOLLOW-UP ACTION REPORT ON THE DECISIONS TAKEN IN THE 3RD MEETING OF THE BOARD OF STUDIES OF CIVIL ENGINEERING DEPARTMENT HELD ON 23.12.2025 (ANNEXURE–4.2, PAGES 4–5 ALREADY CIRCULATED) BE NOTED.

Item 4.3 **Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech. (Civil Engineering) 3rd Year *w.e.f.* 2026-27.**

The Scheme of Studies & Examinations and Syllabi (A-Scheme) for the 2nd Year of B.Tech. (Civil Engineering) was approved by the Board of Studies in its meeting held on 25th May, 2025 and subsequently approved by the Academic Council. The proposed Scheme of Examinations and Syllabi for the 3rd Year, effective from the academic session 2026–27, is placed before the Board as **Annexure 4.3 Pages 6-61.**

The Board of Studies may consider and approve the proposed Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Civil Engineering) of 3rd year.

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (A-SCHEME) OF B.TECH (CIVIL ENGINEERING) OF 3RD YEAR (ANNEXURE–4.3, PAGES 6–61).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Malik

GANGA INSTITUTE OF TECHNOLOGY & MANAGEMENT, KABLANA ★ HOD-CIVIL

Item 4.4 Syllabi of Open Elective Courses offered by Civil Engineering Department for B.Tech. 3rd Year (A-Scheme) effective from the Academic Session 2026–27.

To approve the syllabi of the Open Elective Courses offered by Civil Engineering Department for B.Tech. 3rd Year (A-Scheme **(Annexure 4.4, Pages 62-63)** effective from the Academic Session 2026–27.

Sr. No.	Course Code	Course	Offered by	Departments Eligible to Choose the Course
1	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
2	---------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

RESOLVED THAT THE SYLLABI OF OPEN ELECTIVE COURSES OFFERED BY CIVIL ENGINEERING DEPARTMENT AS MENTIONED ABOVE FOR B.TECH. 3RD YEAR (A-SCHEME), EFFECTIVE FROM THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.4, PAGES 62-63) BE APPROVED.

FURTHER RESOLVED THAT THE APPROVED SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.5 Scheme of Studies & Examinations and Syllabi of B.Tech (Civil Engineering) and B.Tech (Civil Engineering - Working Professionals) 2nd year (B-Scheme as per NEP-2020) *w.e.f.* 2026-27.

The Institute implemented NEP-2020 *w.e.f.* 2025-26 (For 1st Year). The Scheme of Studies & Examinations and Syllabi have been proposed accordingly for 2nd Year common to the B.Tech (Civil Engineering) and B.Tech (Civil Engineering -Working Professionals) **(Annexure 4.5 Pages 64-110).** The revised scheme shall be designated as the B-Scheme in accordance with NEP-2020.

The Board of Studies may consider and approve the proposed Scheme of Studies & Examinations and Syllabi (B-Scheme) common for 2nd year of B.Tech (Civil Engineering) and B.Tech (Civil Engineering -Working Professionals).

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (B-SCHEME) COMMON FOR B.TECH (CIVIL ENGINEERING) AND B.TECH (CIVIL ENGINEERING - WORKING PROFESSIONALS) (ANNEXURE 4.5 PAGES 64-110).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Malik

GANGA INSTITUTE OF TECHNOLOGY & MANAGEMENT, KABLANA ★ HOD-CIVIL

Item 4.6 **Scheme of Studies & Examinations and Syllabi of Minor and Honors Degree Programme in Green Technology & Sustainability Engineering (B-Scheme as per NEP-2020).**

The Institute implemented NEP-2020 *w.e.f.* 2025-26. The Scheme of Studies & Examinations and Syllabi of Minor and Honors Degree Programme in Green Technology & Sustainability Engineering has been revised accordingly under the B-Scheme in accordance with NEP-2020. **(Annexure 4.6 Pages 111-126).**

The Board of Studies may consider and approve the revised Scheme of Studies & Examinations and Syllabi of Minor/Honors Degree Programme in Green Technology & Sustainability Engineering.

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI OF MINOR/HONOURS DEGREE PROGRAMME IN GREEN TECHNOLOGY & SUSTAINABILITY ENGINEERING (ANNEXURE 4.6 PAGES 111-126).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.7 **Panel of Examiners for Theory and Practical Examinations of B.Tech Programme for Academic Session 2026-27.**

The Board of Studies, in its meeting held on 23rd Dec., 2025 vide its Resolution No 3.5, approved the Panel of Examiners. The Board of Studies may now review the existing panel to ensure the inclusion of additional eligible and qualified examiners, if required, to further strengthen the evaluation process for the upcoming academic year **(Annexure 4.7, Pages 127-128).**

RESOLVED THAT THE BOARD OF STUDIES REVIEWED AND APPROVED THE PANEL OF EXAMINAERS FOR THEORY AND PRACTICAL EXAMINATIONS FOR THE ACADEMIC SESSION 2026-27.

FURTHER RESOLVED THAT THE APPROVED PANEL BE FORWARDED TO THE CONTROLLER OF EXAMINATIONS FOR FURTHER NECESSARY ACTION.

Item 4.8 **Any Other Item with the permission of Chair**

There being no other item for discussion, the meeting concluded with a vote of thanks to the Chair.

HOD-CIVIL

Ms. Sheela Malik
Chairperson, Board of Studies
Department of Civil Engineering
Ganga Institute of Technology and Management, Jhajjar

Annexure AC / 5.18

~~Annexure 4.3~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme and Syllabus for

Bachelor of Technology (Civil Engineering)

Third Year (A-Scheme)

(Effective from the session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

B.Tech (Civil Engineering) – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-CE-301A	Design of Steel Structures	3	0	0	3	3	40	60	_	100	3
2	Professional Core Courses	PCC-CE-303A	Hydrology & Water Resource Engineering	3	0	0	3	3	40	60	_	100	3
3	Professional Core Courses	PCC-CE-305A	Soil Mechanics	3	0	0	3	3	40	60	_	100	3
4	Professional Core Courses	PCC-CE-307A	Highway Engineering - I	3	0	0	3	3	40	60	_	100	3
5	Professional Core Courses	PCC-CE-309A	Water Supply and Treatment	3	0	0	3	3	40	60	_	100	3
6	Professional Elective Course Courses	Refer Table 2	Professional Elective-II	3	0	0	3	3	40	60	_	100	3
7	Professional Core Courses / (Lab Course)	LC-CE-311A	Computer-Aided Civil Engineering Drafting Lab (CAD Lab)	0	0	2	2	1	25	_	25	50	-
8	Professional Core Courses / (Lab Course)	LC-CE-313A	Soil Mechanics Lab	0	0	2	2	1	25	_	25	50	-
9	Professional Core Courses / (Lab Course)	LC-CE-315A	Highway Engineering - I Lab	0	0	2	2	1	25	_	25	50	-
10	Project	PROJ-CE-327A	Survey Camp	_	_	_	2	1	25	_	25	50	_
11	Practical Training	PT-CE-329A	*Practical Training - I	0	0	2	2	1	25	_	25	50	*Refer Note 2
Total Credits								**23**				**850**	

Note-1: Students will be allowed to use non-programmable scientific calculator. However, sharing of Calculator and other materials will not be permitted in the examination.

Note-2: The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students.

Note-3: Students must choose one course from the Professional Elective–II category (Table 2). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table 2 Professional Elective – II

S. No	Course Code	Course Name
1	PEC-CE-317A	Advanced Structural Analysis
2	PEC-CE-319A	Air and Noise Pollution
3	PEC-CE-321A	Formwork Engineering and Design
4	PEC-CE-323A	Traffic Engineering
5	PEC-CE-325A	Engineering Geology
6	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

B.Tech (Civil Engineering) – 6th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-CE-302A	Irrigation Engineering and Design	3	0	0	3	3	40	60	_	100	3
2	Professional Core Courses	PCC-CE-304A	Foundation Engineering - I	3	0	0	3	3	40	60	_	100	3
3	Professional Core Courses	PCC-CE-306A	Highway Engineering - II	3	0	0	3	3	40	60	_	100	3
4	Professional Core Courses	PCC-CE-308A	Waste - Water Treatment	3	0	0	3	3	40	60	_	100	3
5	Professional Elective Course Courses	Refer Table 3	Professional Elective-III	3	0	0	3	3	40	60	_	100	3
6	Open Elective Course	Refer Table 4	Open Elective-I	3	0	0	3	3	40	60	_	100	3
7	Professional Core Courses / (Lab Course)	LC-CE-310A	Foundation Engineering lab	0	0	2	2	1	25	_	25	50	-
8	Professional Core Courses / (Lab Course)	LC-CE-312A	Highway Engineering - II Lab	0	0	2	2	1	25	_	25	50	-
9	Professional Core Courses / (Lab Course)	LC-CE-314A	Environmental Engineering Lab	0	0	2	2	1	25	_	25	50	-
10	Professional Core Courses / (Lab Course)	LC-CE-316A	Structural Analysis and Design Lab	1	0	2	3	1	25	_	25	50	-
							Total Credits	**22**				**800**	

Note-1: At the end of the 6th Semester, each student shall undergo 4–6 weeks of Industrial/Practical Training in a Civil Engineering organization and submit a training report along with a training certificate from the organization. The evaluation shall be carried out in the 7th Semester.

Note-2: Students must choose one course from the Professional Elective–III category (Table 3) and one course from the Open Elective–I category (Table 4). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table 3 Professional Elective – III

S. No	Course Code	Course Name
1	PEC-CE-318A	Advanced Steel Structures
2	PEC-CE-320A	Pre-Stressed Concrete
3	PEC-CE-322A	Contracts Management
4	PEC-CE-324A	Hydro-Power Engineering
5	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Table 4 Open Elective Courses – I

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

Course Code	**PCC-CE-301A**				
Category	**Professional Core Course**				
Course Title	**Design of Steel Structures**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To learn IS 800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections. • To study and design of various connections. • To understand behaviour of flexural members and the design laterally restrained and unrestrained beams. • To impart practical knowledge of steel structures and their application.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the properties of structural steel, limit state design concepts, and relevant provisions of Bureau of Indian Standards IS 800:2007.	Level 1: Remember
CO2	Explain the behavior and design requirements of bolted and welded connections, tension members, and compression members.	Level 2: Understand
CO3	Design beams, beam-columns, and basic steel structural members using codal provisions.	Level 3: Apply
CO4	Analyze and design advanced steel structures such as roof trusses, plate girders, and gantry girders.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Introduction:** Stress Strain Curve for Steel, Composition and Properties of Structural Steel, Types of Steel Structures, Types of Sections, Stresses in Structural in Steel, Design Consideration, Codes and Specification, Introduction of Design Philosophies, Different Kind of Loads and their Combination. **Module 2: Connections:** Terminology, Various Types of Connections and their Joints-Riveted, Bolted, Pin, Welded Connections; their Design for Different Loads, Modes of Failure
Unit-II	**Module 3: Design of Tension Member:** Types of Tension Members, Factors Affecting Strength of Tension Member, Design of Tension Members, Lug Angles, Splices, Gussets as per Indian Codal Provision. **Module 4: Design of Compression Members:** Behavior of Compression Members, Types of Compression Member, Effective Length, Slenderness Ratio, Sections Used for Compression Member, Flexural-Torsional Buckling, Prevention of Buckling Failure, Design of Compression

	Members, Design of Built Up Columns- laced and battened columns including the design of lacing and battens, Design of Compression Members Composed of Two Components Back-To-Back.
Unit-III	**Module 5: Design of Beams:** Different Types of Sections in Beams, Lateral Stability of Beam and Factors Affecting Lateral Stability, Design of Laterally Supported and Unsupported Beams, Web Buckling, Web Crippling, Diagonal Buckling, Torsional Buckling, Effect Of Holes In Beams. **Module 6: Design of Column Bases and Footings:** Types of Column, Bases-Slab Bases, Gusset Base, Design of Base plate and Gusseted Base, Design of Bases for Eccentrically Loaded Columns, Anchor Bolts and Shear Connectors, Grillage Foundation
Unit-IV	**Module 7: Plastic Analysis and Design:** Plastic Analysis- Scope, Theory and General Requirement, Ultimate Load-Carrying Capacity of Tension Members, Compression Members, Flexural Members, Shape Factor, Load Factor, Mechanisms, Plastic Collapse, Condition in Plastic Analysis, Method of Analysis, Plastic Analysis And Design of Steel Beams and Simple Portal Frames.

Suggested Readings

- Design of steel structures, A.S. Arya & J.L. Ajmani, Nemchand & Bros., Roorkee.
- Design of steel structures (LSM), N. Subramanian, Oxford Publication.
- Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
- Design of steel structures, S.M.A. Kazmi & S.K. Jindal, Prentice Hall, New Delhi.
- Design of steel structures, S.K. Duggal, TMH Pub, New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Introduction to Structural Steel, Stress-Strain Curve, Properties of Steel	https://youtu.be/5h2V7Xx9mS4
	Riveted, Bolted and Welded Connections	https://youtu.be/X4kQ2zP8mLs
II	Design of Tension Members	https://youtu.be/K6nW8pQ2tXs
	Design of Compression Members and Buckling	https://youtu.be/L8vR3mQ6tWg
III	Design of Laterally Supported and Unsupported Beams	https://youtu.be/J6qV4nP8mRt
	Design of Slab Bases and Gusseted Bases	https://youtu.be/C7vN5mP4xLs
IV	Plastic Analysis and Design	https://youtube.com/playlist?list=PLwBjRwvqBNT3cEx6GL3lQ3dvGfoBaZzUY&si=THBKB-0U9nsaLEhN

Course Code	**PCC-CE-303A**				
Course Category	**Professional Core Course**				
Course Title	**Hydrology and Water Resource Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the fundamental concepts of hydrology and hydrological processes involved in the water cycle. • To develop understanding of precipitation, infiltration, runoff, hydrograph analysis, and flood estimation techniques.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic concepts of hydrology.	Level 1: Remember
CO2	Explain hydrological parameters.	Level 2: Explain
CO3	Apply hydrological concepts.	Level 3: Apply
CO4	Analyze hydrological processes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Introduction:** Hydrologic Cycle, Water-Budget Equation, History of Hydrology and its Application in Engineering, World Water Balance, Sources of Hydrological Data. **Module 2: Precipitation:** Forms of Precipitation, Characteristics of Precipitation in India, Measurement of Precipitation, Rain Gauge Network, Mean Precipitation over an Area, Depth Area-Duration Relationships, Frequency of Point Rainfall, Intensity-Duration-Frequency Curves, Probable Maximum Precipitation (PMP), Rainfall Data in India.
Unit-II	**Module 3: Hydrological Abstractions:** Evaporation Process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for their Reduction, Evapotranspiration and its Measurement, Evapotranspiration Equations, Potential Evapotranspiration over India, Actual Evapotranspiration, Interception, Infiltration Process, Initial Loss, Infiltration Capacity, Factors Affecting Infiltration, Measurement of Infiltration. **Module 4 : Runoff** : Types of Runoff, Runoff Characteristics of Streams, Runoff Volume , Factors Affecting Runoff, Rainfall-Run off Relationships, Estimation of Runoff, SCS-CN Method of Estimating Runoff Volume, Flow Duration Curve, Flow-Mass Curve, Measurement of Stage of Runoff by-Staff Gauge, Wire Gauge, Stream Flow Measurement by Direct and Indirect Methods.

Unit-III	**Module 5: Hydrograph**: Discharge Hydrograph, Components and Factors Affecting Shape of Hydrograph, Effective Rainfall, Base Flow Separation, Unit Hydrograph(UH)-Definition, Assumptions and its Derivation; Unit Hydrograph of Different Durations, Use and Limitations of UH, Snyder`S Synthetic UH. **Module 6: Floods and their Estimation:** Introduction to Floods, Estimation of Floods by: Rational Methods, Empirical Formulae, Unit Hydrograph Technique, Flood Frequency Studies-Gumbel`s Method, Graphical Method.
Unit-IV	**Module 7: Water Resource Planning-I :** Role of Water in National Development, Water Resources and their Assessment , Planning Process, Environmental Consideration in Planning, System Analysis in Water Planning, Common Issues in Project Planning.. **Module 8: Water Resource Planning-II:** Functional Requirements in Multipurpose Projects, Multipurpose Planning, Basin Wise Planning, Long Term Planning, Reservoir Planning-Dependable Yield, Sedimentation in Reservoir, Reservoir Capacity, Empirical-Area Reduction Method.

Suggested Readings

- Engineering Hydrology by K.Subramanya.
- Hydrology by H.M.Raghunath.
- Water Resources Engineering by Linseley and Franzini
- Optimisation Theory and Applications by S.S.Roy
- Water Resources Systems Planning & Economics by R.S.Varshney.

Useful Video Links

Unit No.	Topic	Link
Unit I	Introduction to Hydrologic Cycle and Water Budget Equation	https://youtu.be/unvEFwDg9Fw?si=fW-rdYHcRiS0u2yy
	Precipitation Measurement and IDF Curves	https://youtu.be/hv1y8hVHpiU?si=d_hVL1Rggx7Zprfu
Unit II	Hydrological Abstractions: Evaporation, Infiltration and Evapotranspiration	https://youtu.be/y7Qv3lGr4B4?si=yXqbQNav43JSlEZu
	Runoff Estimation and SCS-CN Method	https://youtu.be/55U7OEWXG18?si=uNcYoFt6K8Xo_Dcy
Unit III	Hydrograph and Unit Hydrograph Analysis	https://youtu.be/B9hMtK-zKOA?si=RIF0wdsGLnucVmhs
	Flood Estimation and Frequency Analysis	https://youtu.be/9HFj8ZrAVeA?si=YBpruTEX4NK-mu2X
Unit IV	Water Resource Planning and System Analysis	https://youtu.be/vDr1PiNhYz8?si=cIErPcdeUuq_LB-h
	Reservoir Planning and Sedimentation Analysis	https://youtu.be/vDr1PiNhYz8?si=9gD82maY0jL5sBK3

Course Code	**PCC-CE-305A**				
Category	**Professional Core Course**				
Course Title	**Soil Mechanics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the fundamental engineering properties and classification of soils. • To develop understanding of compaction, permeability, seepage, and effective stress concepts in soils. • To analyze stress distribution, consolidation, and settlement behavior of soil masses. • To study shear strength characteristics and laboratory testing methods for geotechnical analysis and design.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic concepts of soil mechanics.	Level 1: Remember
CO2	Explain the engineering properties of soils.	Level 2: Understand
CO3	Apply soil mechanics principles to engineering problems.	Level 3: Apply
CO4	Analyze the behavior of soils under different conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Basic Soil Properties:** Introduction to Soil Mechanics; Origin and Formation of Soils; Residual and Transported Soils; Soil Profile; Soil Structure; Types of Soils; Three-Phase System; Index Properties; Weight–Volume Relationships; Grain Size Analysis (Sieve and Hydrometer Analysis); Grain Size Distribution Curve. **Module 2: Soil Classification & Clay Mineralogy:** Index Properties; Atterberg Limits; Clay Mineralogy (Kaolinite, Illite and Montmorillonite); Activity of Clay; Soil Classification Systems (USCS, ISSCS and AASHTO); Plasticity Chart; Engineering Properties of Fine-Grained Soils.
Unit-II	**Module 3: Fundamentals of Compaction:** Compaction Principles; Compaction and Consolidation; Standard and Modified Proctor Tests; Compaction Characteristics (OMC and MDD); Zero Air Voids Line; Factors Affecting Compaction; Field Compaction; Field Density Tests (Sand Replacement and Core Cutter Methods); Relative Compaction and Quality Control. **Module 4: Permeability & Seepage:** Permeability of Soils; Darcy's Law; Laboratory Determination of Permeability (Constant Head and Falling Head Tests); Equivalent Permeability of Layered Soils; Seepage Analysis; Flow Nets; Seepage Velocity and Discharge Velocity; Hydraulic Gradient; Seepage Pressure; Quick Sand Condition; Piping; Capillarity.

Unit-III	**Module 5: Effective Stress in Soil Mass:** Total, Neutral and Effective Stress; Terzaghi's Effective Stress Principle; Effective Stress under Submerged, Seepage and Capillary Conditions; Critical Hydraulic Gradient; Seepage Force; Sensitivity of Soils. **Module 6: Stress Distribution in Soil:** Boussinesq and Westergaard Theories; Stress Distribution due to Point, Line, Strip and Circular Loads; Pressure Bulbs; Isobars; Newmark's Influence Chart; Contact Pressure under Rigid and Flexible Footings.
Unit-IV	**Module 7: Consolidation of Soil:** Consolidation Theory; Compression and Swelling Indices; Terzaghi's One-Dimensional Consolidation Theory; Consolidation Parameters; Oedometer Test; Normally Consolidated and Over-Consolidated Soils; Over-Consolidation Ratio (OCR); Preconsolidation Pressure; Settlement Analysis (Immediate, Primary and Secondary Settlement). **Module 8 :Shear Strength of Soil:** Shear Strength Theory; Mohr-Coulomb Failure Criterion; Mohr Circle; Shear Strength Parameters; Stress–Strain Behaviour of Soils; Direct Shear, Triaxial, Unconfined Compression and Vane Shear Tests; Drained and Undrained Shear Strength; Stress Path (Introduction).

Suggested Readings

- Bolton, M. D., A guide to soil mechanics (2nd ed.). Macmillan Education.
- Lambe, T. W., & Whitman, R. V., Soil mechanics. Wiley.
- Coduto, D. P. (2001). Foundation design: Principles and practices (2nd ed.). Prentice Hall.
- Venkatramaiah, C. (2006). Geotechnical engineering (3rd ed.). New Age International Publishers.
- Arora, K. R. (2019). Soil mechanics and foundation engineering (8th ed.). Standard Publishers Distributors.
- Garg, S. K. (2018). Soil mechanics and foundation engineering (9th ed.). Khanna Publishers.
- Mitchell, J. K., & Soga, K. (2005). Fundamentals of soil behavior (3rd ed.). Wiley.
- Schofield, A. N., & Wroth, C. P., Critical state soil mechanics. McGraw-Hill.
- Das, B. M. (2016). Principles of foundation engineering (8th ed.). Cengage Learning

Useful Video Links

Unit No.	Topic	Link
Unit-I	Basic Soil Properties	https://youtu.be/afirGWlleSM?si=T7PcZ76V3tCSeJlB
	Soil Classification & Clay Mineralogy	https://www.youtube.com/live/u2KhP8DuMJI?si=LiiGg-XiprgAg78n
Unit-II	Fundamentals of Compaction	https://youtu.be/A7eiILKx3mc?si=23Lnj_aFDkzUhLzj
	Permeability & Seepage	https://youtu.be/TYBhuXspwpE?si=bWmiyo_9OOnoahVA
Unit-III	Effective Stress in Soil Mass	https://www.youtube.com/live/m5wWNxi1Y2g?si=iolh94FHHAm66OE1
	Stress Distribution in Soil	https://www.youtube.com/live/14gPn0upVH0?si=tKcF-PX3UhtCwgtJ
Unit-IV	Consolidation of Soil	https://www.youtube.com/live/l0Kac4zuhOg?si=9jF7hWqUx9yN0Gvp
	Shear Strength of Soil	https://www.youtube.com/live/K-6Gs5hlFyg?si=uvNGPJhgM7QgUKbh

Course Code	**PCC-CE-307A**				
Category	**Professional Core Course**				
Course Title	**Highway Engineering - I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To understand fundamentals of highway engineering, planning, design and materials. • To apply design principles and traffic studies for safe roads. • To evaluate modern techniques like traffic control and ITS.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basics of highways, materials and traffic engineering.	Level 1: Remember
CO2	Explain planning, alignment and geometric design.	Level 2: Understand
CO3	Apply design principles and traffic/material testing methods.	Level 3: Apply
CO4	Analyze traffic, safety and material performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Introduction:** Modes of Transportation, History of Road Development, Scope of Highway Engineering, Road Development Plans in India, PMGSY and other Highway Projects, Classification of Highways, Locations and Functions, Road Patterns. **Module 2: Highway Development and Planning:** Necessity and Significance of Highway Planning, Highway Alignment and Surveys, Factors Influencing Highway Alignment, Engineering Surveys for Alignment, Conventional and Modern Methods of Highway Alignments.
Unit-II	**Module 3: Highway Geometric Design:** Urban, Rural Roads and their Cross-Sections, Design of Cross Section Elements- Right of Way and Width Considerations, Roadway, Shoulders, Kerbs Traffic Barriers, Medians, Frontage Roads; Facilities for Pedestrians, Bicycles, Buses and Trucks, Traffic Separators and Road Margin, Design of Sight Distances, IRC Recommended Values. **Module 4: Design of Horizontal and Vertical Alignment:** Super-Elevation and its Design, Extra-Widening, Radius of Circular Curves, Length of Transition Curves, Gradient, Summit and Valley Curves, Introduction to Software like MXROAD.
Unit-III	**Module 5: Highway Material – I :** Soil and Aggregate Subgrade Soil and its Characteristics, Compaction Methods, Evaluation of Soil Strength by Different Tests, Aggregates and their Characteristics, Various Tests on Aggregates, IRC/IS Specifications for Suitability of Aggregates.

	Module 6: Highway Material – II : Bituminous Materials and Bituminous Mixes Bitumen: Origin, Preparation, Properties and their Testing Methods, Bituminous Road Binders: Requirements Constitution, Selection Criterion for Different Binders, Bituminous Emulsions and Cutbacks: Preparation, Characteristics, uses and their Tests. Bituminous Mixes: Mechanical Properties and Characteristics, Bituminous Mix Design: Methods, Performance-Based Bitumen Specifications, Polymers and Rubber Modified Bitumen in Bituminous Mixes, Waste Plastic in Bituminous Mixes.
Unit-IV	**Module 7: Traffic Engineering and Control:** Traffic Characteristics, Traffic Studies and their Presentation, Traffic Capacity Studies, PCU and Axle Load Survey, Intersections Design, Design of Sign and Signals, Parking and Accident Studies, Highway Safety Measures. **Module 8: Intelligent Transportation Systems (ITS):** Objectives of Intelligent Transportation Systems, Historical Background, Benefits of ITS, Data Collection Techniques for ITS-Detectors, Automatic Vehicle Location, Automatic Vehicle Identification, Geographic Information Systems and Video Data Collection.

Suggested Readings

- Khanna, S.K. and Justo, C.E.G., Highway Engineering, Nem Chand & Bros.
- Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers.
- Partha Chakraborty and Animesh Das, Principles of Transportation Engineering, PHI Learning.
- Papacostas, C.S. and Prevedouros, P.D., Transportation Engineering and Planning, Prentice Hall.
- Sharma, S.K., Principles, Practice and Design of Highway Engineering, S. Chand Publications.
- IRC Codes and Specifications, Indian Roads Congress.
- Relevant publications of Ministry of Road Transport and Highways

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction to Highway Engineering and Road Development in India	https://www.youtube.com/live/JZQSidZQRj8?si=KW5cH30rbL15TSo5
	Highway Planning and Alignment Surveys	https://youtu.be/Co4ZKhY2E1Q?si=vo-RSLV3nWMXaGg5
Unit-II	Highway Cross-Section Elements	https://youtu.be/ynae0uz2qYs?si=TNeK1XWtI37YdqxW
	Horizontal Curve Design, Super Elevation and Extra Widening	https://youtu.be/tIkBEky7WsY?si=2ztxA7HWIEVx6KVa
Unit-III	Soil and Aggregate Testing for Highway Materials	https://youtu.be/959mcz2nX9k?si=jTwaAZP5NOB1RLLo
	Bituminous Materials and Testing Methods	https://youtu.be/8DkY55EKKR4?si=exnkVheYx0zkDFpL
Unit-IV	Traffic Engineering Studies and PCU Analysis	https://youtu.be/dc1ndNtjwP8?si=vqcqFWUVRgqmcyGe
	Intelligent Transportation Systems (ITS)	https://youtu.be/OnjX0O9dPMc?si=f__Ikt4Yx0o0fHZJ

Course Code	**PCC-CE-309A**				
Course Category	**Professional Core Course**				
Course Title	**Water Supply and Treatment**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To quantify the water demands and its variations. • To analyze the different characteristics of water. • To study the different units of treatment. • To deal with water supply and water distribution to consumers. • To develop basic knowledge about the water pollution and its control.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the concepts of water demand estimation, source selection, water quality characteristics, and standards for water supply systems.	Level 1: Remember
CO2	Explain water treatment processes, advanced treatment methods, and the operational principles of various treatment units.	Level 2: Understand
CO3	Apply principles of water conveyance, pumping, and distribution system design for efficient water supply management.	Level 3: Apply
CO4	Analyze water pollution issues and evaluate suitable treatment, distribution, and control measures for sustainable water supply systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Module 1: Introduction:** Water Supply System – Planning, Objectives, Design Period, Population Forecasting, Water Demands and its Variations, Sources of Water and their Characteristics, Development and Selection of Source, Intakes and their Types. **Module 2: Water Characteristics:** Sources of Impurities, Type of Impurities in Water and their Sanitary Significance, Physical, Chemical and Bacteriological Analysis of Water, Indian and Global Standards of Water Quality, Effluent Standards.
Unit-II	**Module 3: Water Treatment:** Necessity of Water Treatment , Flow Diagram of Different Treatment Units; Constructional Details, Working and Operation of Preliminary Units, Aeration Units, Sedimentation Units and their Types, Features and Design Aspects; Mixing Basins, Flocculation; Filtration – Mechanisms, Characteristics and Design of Slow and Rapid Sand Filtration Unit; Disinfection - Theory, Methods and Practices.

	Module 4: Advanced Water Treatment: Water Softening, Desalination- R.O. Plant, Demineralization, Adsorption, Ion Exchange, Membrane Systems; Iron and Manganese Removal, Defluoridation, Dissolved Solids Removal.
Unit-III	**Module 5: Water Conveyance System:** Methods of Supply - Intermittent and Continuous, Pipes and Conduits for Water- Pipe Materials, Laying, Jointing and Testing of Pipes, Valves and Appurtenances. **Module 6: Pumps and Pumping Stations:** Need of Pumping, Terminology used, Classification of Pumps, Different Type of Pumps used in Water Supply, Power of Pumping, Total Lift of Pump, Location of Pumping Station, and Site Selection.
Unit-IV	**Module 7: Water Distribution System:** Requirements of Water Distribution, Type of Distribution System, Layout of Distribution System – Dead End System, Grid Iron System, Ring System, Radial System and their Merits and Demerits; Distribution Reservoir-Functions and Determination of Storage Capacity, Water Distribution Network- Layout, Capacity, Pressure Requirements, Analysis; Leak Detection and Maintenance of Water Distribution Network. **Module 8: Water Pollution and Control:** Sources of Water Pollution, Types and their Effects, Preventive Measures and Control of Water Pollution, Description of Legislation Related to Water Pollution Control.

Suggested Readings

- Water Supply Engineering: S.R. Kshirsagar.
- Water Supply Engineering: S.K. Garg.
- Water Supply Engineering: B.C. Punmia.
- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie 8. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Water Supply System	https://youtu.be/zu6UfycMkw4?si=FyRtdTBkghPbVY9b
	Sources of Impurities	https://youtu.be/bu609FNz6VI?si=kYw9VzMCIHegUBzS
II	Water Treatment	https://youtu.be/jvQn9lMI79M?si=uVsstS95bLUQrWFk
	Advanced Water Treatment	https://youtu.be/4-SRMmqH2s4?si=GnmECJao0hpO8Wep
III	Water Conveyance System	https://youtu.be/zu6UfycMkw4?si=r11ZWAXwhwHEZnBP
	Pumps and Pumping Stations	https://youtu.be/u9cbqLCylf4?si=us_lA2dIKq9eECAr
IV	Water Distribution System	https://youtu.be/zVZ9c6EXfTA?si=s5ZnBOBW_TaEjKKo
	Sources of Water Pollution	https://youtu.be/t1xu2A8ItNE?si=ue-YjkfbZC7o1tmF

Course Code	**LC-CE-311A**				
Category	**Lab Course**				
Course Title	**Computer-Aided Civil Engineering Drafting Lab (CAD Lab)**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are: • To familiarize students with AutoCAD and drafting standards used in civil engineering. • To develop skills in preparing 2D and 3D architectural drawings. • To impart knowledge of structural detailing of steel members and foundations. • To enable students to prepare professional engineering drawings using CAD tools.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall AutoCAD commands and drafting standards.	Level 1: Remember
CO2	Interpret engineering drawings and drafting conventions.	Level 2: Understand
CO3	Apply AutoCAD tools to prepare architectural drawings.	Level 3: Apply
CO4	Analyze and develop detailed structural and civil engineering drawings.	Level 4: Analyze

List of Experiments

- Study and application of basic AutoCAD commands, layers, dimensioning, hatching, blocks, and plotting techniques.
- Preparation of 2D architectural drawings of a residential building including plan, elevation, and section.
- Preparation of detailed working drawings of a residential building including doors, windows, and staircase details.
- Preparation of 3D architectural models and rendered views of a residential building.
- Preparation of detailed drawings of bolted and welded steel connections.
- Preparation of detailed drawings of beam-to-column connections and column base connections (slab base and gusseted base).
- Preparation of detailed drawings of laced and battened columns and built-up steel beams.
- Preparation of detailed drawings of grillage foundations and other steel foundation systems.
- Preparation of detailed drawings of plate girders and gantry girders.
- Preparation of circular and rectangular water tank drawings
- Preparation of detailed drawings of roof trusses and industrial steel roof systems.

Useful Video Links

Exp. No	Topic	Link
1	Study of AutoCAD commands, layers, dimensioning, hatching, blocks, and plotting	AutoCAD Basic Tutorial for Beginners
2	Preparation of 2D architectural drawings of a residential building	2D Building Plan in AutoCAD

3	Preparation of detailed working drawings of a residential building	House Plan Drawing in AutoCAD
4	Preparation of 3D architectural models and rendered views	AutoCAD 3D Modeling Tutorial
5	Preparation of detailed drawings of bolted and welded steel connections	Steel Connection Detailing in AutoCAD
6	Preparation of beam-to-column and column base connections	Beam Column Connection AutoCAD Tutorial
7	Preparation of laced and battened columns and built-up steel beams	Steel Structure Detailing in AutoCAD
8	Preparation of grillage foundation drawings	Grillage Foundation Drawing in AutoCAD
9	Preparation of plate girder and gantry girder drawings	Plate Girder Detailing in AutoCAD
10	Preparation of circular and rectangular water tank drawings	Water Tank Drawing in AutoCAD
11	Preparation of roof truss and industrial roof system drawings	Roof Truss Drawing in AutoCAD

Course Code	**LC-CE-313A**				
Category	**Lab Course**				
Course Title	**Soil Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are: • To develop the ability to identify and classify soils, • To understand and perform standard laboratory and field tests, • To apply effective application of geotechnical principles in engineering practice. • To analyze key soil properties such as moisture content, density, permeability, compaction, and shear strength,				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic soil properties, definitions, and standard test procedures.	Level 1: Remember
CO2	Understand principles of soil tests like sieve analysis, Atterberg limits, compaction, permeability, and shear strength.	Level 2: Understand
CO3	Conduct soil tests to determine index properties, density, compaction, and strength parameters.	Level 3: Apply
CO4	Analyze results to classify soil and evaluate its engineering behavior and suitability.	Level 4: Analyze

List of Experiments

1. Visually classify the soil and to determine the moisture content (water content) of a given soil sample.
2. Determination of specific gravity of given soil sample.
3. To classify the coarse grained soil by sieve analysis using particle size distribution curve.
4. To determine liquid limit and plastic limit.
5. To determine field density of soil by

a. Sand replacement method
b. Core cutter method

6. To determine the optimum moisture content and maximum dry density of soil by Standard Proctor Test.
7. To determine the coefficient of permeability of soil sample at desired density by suitable Method.
8. To determine the Unconfined compressive strength of cohesive soil sample.
9. To determine the shear strength parameters of the given granular soil sample at known Density and moisture content by Direct shear test.
10. To determine the shear strength parameters of fine grained soil sample by unconsolidated undrained (UU) Triaxial test.

Useful Video Links

Exp. No	Topic	Link
1	Moisture content (water content) of a given soil sample.	https://youtu.be/N2J-tvEeI4c?si=HPmyFt2nGdz5ZWrn
2	Sand replacement method	https://youtu.be/YejCi5SEOAU?si=c2whwbxWVkt67wZ
3	Maximum dry density of soil by Standard Proctor Test.	https://youtu.be/c4i_y6utsE?si=XQMzJcCMbRInI7NF
4	Direct shear test.	https://youtu.be/bmpn5oNDvOs?si=JaBs4NQWphAlzx_W

Course code	**LC-CE-315A**				
Category	**Lab Course**				
Course title	**Highway Engineering-I Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are: • To understand the characterization of highway materials as per IRC/IS codes. • To learn the mix designs of granular, bituminous and CC mixes • To learn the use of modern equipment for traffic studies and pavement evaluation				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall standard laboratory procedures and testing methods for aggregates, soils, and pavement materials.	Level 1: Remember
CO2	Explain engineering properties of aggregates and pavement materials based on experimental observations.	Level 2: Understand
CO3	Perform laboratory and field tests to evaluate strength, durability, and performance characteristics of transportation materials.	Level 3: Apply
CO4	Analyze test results and assess the suitability of construction materials and traffic parameters for pavement and highway engineering applications.	Level 4: Analyze

List of Experiments

1. To determine the flakiness index and elongation index of aggregates.
2. To determine the California Bearing Ratio (CBR) value of soil and aggregate.
3. To determine the impact value of aggregate and composite material.
4. To determine the crushing strength of aggregate and composite material.
5. To determine the abrasion and attrition value of aggregate by using:
   a) Deval abrasion test.
   b) Los Angeles abrasion test
   c) Dory abrasion test.
6. To determine the water absorption of aggregate.
7. To find out the Soundness/durability of aggregate.
8. To determine the mechanical and wear properties of tiles/blocks:-a) Flexural strength b)Abrasion value of tiles/blocks.
9. Traffic volume and speed study using videography technique.(Demonstration only)

Useful Video links:

Virtual Lab :https://ts-nitk.vlabs.ac.in/List%20of%20experiments.html

Exp. No	Topics	Links
1	To determine the flakiness index and elongation index of aggregates.	https://youtu.be/Rx9Fvvxepmw?si=f-GsxdNwhwpuYYRz

2	To determine the California Bearing Ratio (CBR) value of soil and aggregate.	https://youtu.be/fCmMW73rP64?si=8-3Vn_FIkLpEWO-g
3	To determine the impact value of aggregate and composite material.	https://youtu.be/Mn7aeorMpTs?si=HYMOIilC2QMRYb7i
4	To determine the crushing strength of aggregate and composite material.	https://youtu.be/lE7LFOuGKyI?si=EFz0BMZL0Aj6K3Oz
5	To determine the abrasion and attrition value of aggregate by using Los Angeles abrasion test	https://youtu.be/k6wXH50Kwkw?si=nQ-Vfy_awfjTO5Y6
6	To determine the water absorption of aggregate.	https://youtu.be/hqXFPq676iM?si=SkcZEamwpa0FCORy
7	To find out the durability of aggregate.	https://youtu.be/4OY03u4B4t4?si=nhLRN7cEjss9H-mx

Course Code	**PROJ-CE-327A**				
Category	**Project**				
Course Title	**Survey Camp**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are: • Survey camp emphasizes on field application of basic survey task such as triangulation, base line measurement, leveling, contouring and topographic surveying of land using plane table methods. • It imparts knowledge of projection of land features on a plane sheet on a chosen scale. • To make the student capable of drawing survey site plans and maps independently of a chunk of land of hilly area.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the principles, methods, and instruments used in field surveying practices.	Level 1: Remember
CO2	Explain the procedures involved in leveling, triangulation, contouring, and plane table surveying.	Level 2: Understand
CO3	Apply surveying techniques using appropriate instruments to collect field data and locate control points accurately.	Level 3: Apply
CO4	Analyze field observations and prepare topographic maps representing physical features of the surveyed area.	Level 4: Analyze

Course Content

The survey camp is to be carried out by the students at suitable site. Different group of students will be asked to survey a particular area by using appropriate instruments issued to them. They will use different methods of surveying i.e. leveling, base line measurement, contouring, triangulation, plane table method to locate different control points. The students will plot important objects and features of the area under consideration on plane table sheet and prepare topographic map of the area.

Course Code	PEC-CE-317A				
Category	Professional Elective courses				
Course Title	Advanced Structural Analysis				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	1	0	4	
Course Objectives	The objectives of this course are: • To develop understanding of advanced structural analysis methods for indeterminate structures. • To introduce matrix methods for analysis of trusses, frames, and curved structures. • To study flexibility and stiffness approaches for structural system analysis. • To develop analytical and computational skills for solving practical structural engineering problems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the theoretical concepts of arches, matrix methods, structural indeterminacy, and energy principles.	Level 1: Remember
CO2	Explain stiffness and flexibility methods for analysis of framed structures under various loading conditions.	Level 2: Understand
CO3	Apply matrix methods to analyze arches, plane trusses, frames, partially discontinuous structures, and curved beams.	Level 3: Apply
CO4	Analyze complex structural systems using computational techniques and interpret results for engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Fundamentals of Matrix Structural Analysis:** Structural idealization, coordinate systems, degrees of freedom, static and kinematic indeterminacy, generalized forces and displacements, flexibility and stiffness concepts, strain energy principles, force-displacement relationships.. **Module 2: Matrix Stiffness method:** Development of element stiffness matrices by physical approach, stiffness matrices for truss, beam and frame elements, displacement transformation matrix, equivalent joint loads, assembly of global stiffness matrix, analysis of plane trusses and plane frames..
Unit-II	**Module 3: Matrix Flexibility method:** Development of flexibility matrices, flexibility matrices for truss and frame elements, force transformation matrix, assembly of global flexibility matrix, analysis of statically indeterminate trusses and frames.

	Module: Advanced Matrix Analysis: Analysis of structures subjected to nodal loads and member loads, temperature effects, lack of fit, support settlement, comparison of flexibility and stiffness methods.
Unit-III	**Module 5: Advanced Analysis of Arches:** Analysis of two-hinged and fixed arches, elastic centre, effects of rib shortening, temperature variation and yielding of supports, tied arches, influence lines for two-hinged arches. **Module 6: Curved Beams:** Analysis of beams curved in plan, stress resultants in curved members, radial bending moments, torsional effects, semicircular beams subjected to concentrated loads and uniformly distributed loads.
Unit-IV	**Module 7: Advanced Structural Systems:** Partially restrained and partially discontinuous members, development of stiffness matrices for partially discontinuous members, substructure technique, structural condensation, effects of axial force on flexural stiffness. **Module 8: Applications of Matrix Methods:** Application of matrix stiffness and flexibility methods to complex trusses and frames, interpretation of structural response, comparison of classical and matrix methods of structural analysis.

Suggested Readings

1. Matrix Analysis of Structures, Gere & Weaver, CBS Publishers and Distributors, Delhi 110032.
2. Structural analysis, T.S. Thandavamoorthy, Oxford University Press.
3. Concepts and applications of finite element analysis Robert D. Cook, Wiley India Pvt. Ltd.
4. Advanced Structural Analysis, Ashok K. Jain, Nem Chand and Bros., Roorkee. H. C. Martin,
5. Introduction to Matrix Methods of Structural Analysis. McGraw Hill. Amin Ghali, Adam Neville, Tom G. Brown
6. Structural Analysis: A Unified Classical and Matrix Approach, CRC Press

Useful Video Links

Unit No.	Topic	Link
Unit-I	Arches	https://www.youtube.com/live/Z1p2PYAlaVw?si=ab89RA6qP_cUhZi7
	Stiffness method	https://youtu.be/2-7G35K_KD8?si=yZvPKRLqfB2hFBkm
Unit-II	Basic Principles of Matrix Method	https://youtu.be/58DrizBBo7s?si=zOHhvSEKVeON4pup
	Flexibility method	https://youtu.be/dICHBu2aODQ?si=baHq0N6C8ObFgowI
Unit-III	Partially Discontinuities Structures	https://youtu.be/zNoBjMcsQck?si=2PYl2lSVTJKvM7tp
	Method of Sub-structure Analysis and stresses:	https://www.youtube.com/live/goEfXwQLmqI?si=U8K2mVfoqhsRwgRl
Unit-IV	Beam of Curved in Plan	https://youtu.be/JDkb5sfU4rk?si=YB8QdNaBza3P-jcP
	Computer Programs for Matrix Structural Analysis	https://youtu.be/XZ5FMKUnrpI?si=eeC1Q3z4rNPHbLNH

Course Code	**PEC-CE-319A**				
Course Category	**Professional Elective Course**				
Course Title	**Air and Noise Pollution**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • Understanding of basic concepts of air pollution. • To understand the basic characteristics of air pollutants. • To provide adequate knowledge about the noise pollution. • To have adequate knowledge on various type of sounds.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the fundamentals of air and noise pollution, atmospheric composition, pollutant sources, standards, and environmental regulations.	Level 1: Remember
CO2	Explain pollutant dispersion mechanisms, air quality assessment methods, and the environmental impacts of air and noise pollution.	Level 2: Understand
CO3	Apply air quality monitoring techniques, dispersion models, and pollution control technologies for environmental management.	Level 3: Apply
CO4	Analyze air and noise pollution problems and evaluate suitable control measures for sustainable environmental protection.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Module 1: Air Pollution:** Composition and Structure of Atmosphere, Air Pollution and Global Climate, Air Quality Criteria, Emission Standards, National Ambient Air Quality Standards, Air Quality Management in India **Module 2: Sources, Classification and Effects:** Sources and Classification of Air Pollutants, Type of Air Pollutants, Pollution due to Automobiles, Analysis of Air Pollutants – Chemical, Instrumental and Biological Methods; Air Pollution and its Effects on Human health, plants, animals and microbes, archaeological monuments and aesthetics
Unit-II	**Module 3: Pollutant Dispersion:** Concept of Atmospheric Stability, Adiabatic and Environmental Lapse Rate, Plume Behaviour, Terrain and Structure on Pollutant Dispersion, factors affecting Pollutant Dispersion, Concept of Maximum Mixing Depth and Ventilation Coefficient, Plume Rise and Effective Stack Height.

	Module 4: Air Quality: Objectives, Time and Space Variability in Air Quality; Air Sampling Design, Analysis and Interpretation of Air Pollution Data, Introduction to Air Quality Index and Comprehensive Environmental Pollution Index and its Application, Sampling and Measurement of Air Pollutants Guidelines of Network Design in Urban and Rural areas, Stack Monitoring.
Unit-III	**Module 5: Dispersion Modelling and Impacts of Air Pollution:** Dispersion modelling, it's Applications and Limitations, Gaussian Plume Model and GLC Determination, Global Environmental Issues: Acid Rain, Global Warming, Smog, Ozone layer depletion, Combustion of Fuel, Indoor Air Pollution, Various Treaties and Protocols: Kyoto Protocol and Montreal Protocol. **Module 6: Air Pollution Control:** Introduction to Control Methods and Equipment for Particulate Matter and Gases, Design and Working of Scrubbers, Electrostatic Precipitator, Gravity Settlers, Cyclone Separator, Filter Bags , Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their Control.
Unit-IV	**Module 7: Noise Pollution:** Sound and Noise, Sources of Noise Pollution – Environmental and Industrial, Characteristics of Sound and its Measurement, Levels of Noise, Noise Rating Systems, Noise Level Standards, Outdoor and Indoor Noise Propagation; Psychoacoustics and Noise Criteria Curves. **Module 8: Effects of Noise and Control Methods:** Effects on Human and Environment, Infra-Sound, Ultrasound, Impulsive Sound and Sonic Boom; Noise Standards and Permissible Values; Instrumentation and Monitoring Procedure, Noise Indices and Control Methods.

Suggested Readings

- Air and Noise Pollution Control : Lawrence K. Wang
- Advanced Air and Noise Pollution Control: Volume 2 : Lawrence K. Wang
- Environmental Pollution and Health : V. K Ahluwalia
- Atmospheric pollution: Mark Z. Jacobson

Useful Video Links

Unit No.	Topic	Link
I	Air Pollution	https://youtu.be/5dukz1UOtkA?si=BDfmh2fxkAJ8v35Z
	Sources, Classification and Effects	https://youtu.be/0pkcaLyNuCE?si=dZ3KAWWGOHPnqH5j
II	Pollutant Dispersion	https://youtu.be/2adBRvVp8VA?si=ujYCUIBMdwW0Ccfr
	Air Quality	https://youtu.be/YrI8r_xOzpY?si=S0BsFMt4gXM0q2oL
III	Impacts of Air Pollution	https://youtu.be/4AuwG2G_ERU?si=RLgQ6LrC1o3uySSp
	Air Pollution Control	https://youtu.be/qPEDRZoVr1Y?si=qHrg2BAlgwgMpwbE
IV	Noise Pollution	https://www.youtube.com/live/9qWB1sMnfLE?si=teyLqrjwTXuwZ9FQ
	Control Methods	https://youtu.be/DLJhIJjJHus?si=fz9STbqN027Y9GDB

Course Code	**PEC-CE-321A**				
Course Category	**Professional Elective Course**				
Course Title	**Formwork Engineering and Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the fundamentals, materials, and functional requirements of formwork systems in construction. • To develop understanding of design principles for various formwork components under different loading conditions. • To study conventional, modular, and advanced formwork systems used in modern construction practices. • To develop practical knowledge of formwork erection, dismantling, safety, quality control, and special applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the basic concepts, materials, requirements, and classification of formwork systems.	Level 1: Remember
CO2	Explain the design principles, loading conditions, and construction procedures of various formwork systems.	Level 2: Understand
CO3	Apply formwork design principles for beams, slabs, columns, walls, and other structural components.	Level 3: Apply
CO4	Analyze modern formwork systems, safety requirements, and advanced applications for complex construction projects.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Module 1: Basics and Requirements:** Formwork engineering, definition of formwork, objectives of formwork, requirements of good formwork, functions of formwork, classification of formwork systems. **Module 2: Materials for Formwork:** Timber formwork, plywood formwork, steel formwork, aluminium formwork, plastic formwork, composite formwork systems, properties of formwork materials, selection criteria of formwork materials.
Unit-II	**Module 3: Design Principles:** Loads on formwork, vertical loads, lateral loads, pressure of fresh concrete, factors affecting formwork pressure, design of formwork components, safety considerations in design.

	Module 4: Design of Elements: Design of beam formwork, slab formwork, column formwork, wall formwork, footing formwork, design of formwork supports, bracing and ties.
Unit-III	**Module 5: Conventional and Modern Systems:** Conventional formwork systems, modular formwork, table formwork, tunnel formwork, slip formwork, jump formwork, climbing formwork. **Module 6: Erection and Dismantling:** Erection of formwork, alignment and levelling, inspection of formwork, stripping of formwork, de-shuttering time, reuse of formwork, maintenance of formwork.
Unit-IV	**Module 7: Safety and Quality Control:** Safety in formwork construction, quality control measures, common formwork failures, prevention of failures, inspection and monitoring. **Module 8: Advanced and Special Formwork Applications:** Formwork for high rise structures, formwork for bridges, formwork for tunnels, formwork for curved and shell structures, use of mechanized and automated formwork systems.

Suggested Readings

- Peurifoy, R.L. and Oberlender, G.D., Formwork for Concrete Structures, McGraw Hill.
- Hurd, M.K., Formwork for Concrete, American Concrete Institute.
- Kumar Neeraj Jha, Construction Project Management, Pearson Education.
- Punmia, B.C., Building Construction, Laxmi Publications.
- Chudley, Roy, Construction Technology, Pearson Education.
- Relevant standards of Bureau of Indian Standards and American Concrete Institute.

Useful Video Links

Unit No.	Topic	Link
I	Basics and Requirements of Formwork	https://youtu.be/t2q8jzkHK8E?si=NPq0kPVu5BSaj-MF
	Formwork Materials and Selection Criteria	https://youtu.be/6HkfLfpGSrs?si=q1dIOKCf9E9hRXBk
II	Loads on Formwork and Design Principles	https://youtu.be/xSCYsb_d3Ao?si=gNsos3lEE9yMCE33
	Design of Beam, Slab and Column Formwork	https://youtu.be/blRjnui_dE8?si=fzWrm6Dw-vysPNbV
III	Modular, Tunnel and Slip Formwork Systems	https://youtu.be/bA3OsOsrRgc?si=EsUQRC8bB5xsyxOW
	Erection and Dismantling of Formwork	https://youtu.be/Avt7Ydmfo8M?si=ref3s4Ecjo9SvVnX
IV	Formwork Safety and Quality Control	https://youtu.be/AVLM5UnaCy0?si=qgfEJIzmCTIk8OZX
	Formwork for High-rise and Bridge Construction	https://youtu.be/geRS0SJMBKs?si=2hHP7nn-tGtwqIxu

Course Code	**PEC-CE-323A**				
Course Category	**Professional Elective Course**				
Course Title	**Traffic Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To understand traffic characteristics, traffic studies and traffic control for efficient road transportation. • To develop knowledge of road safety, capacity analysis and environmental aspects of traffic engineering.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define traffic characteristics, road user and vehicular characteristics.	Level 1: Remember
CO2	Explain traffic studies and effects on road design elements.	Level 2: Understand
CO3	Apply methods of traffic surveys (volume, speed, O-D, delay).	Level 3: Apply
CO4	Analyze traffic flow, capacity, level of service and safety aspects.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Traffic Characteristics:** Importance of traffic characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road. **Traffic Studies**: volume study, speed study and origin and destination study. Speed and delay study. Use of photographic techniques in traffic surveys.
Unit-II	**Traffic Accidents:** Accident surveys. Causes of road accidents and preventive measures, Capacity and Level of Service: Fundamental diagram of traffic flow. Relationship between speed, volume and density, Level of service, PCU, Design service volume, Capacity of non-urban roads. IRC recommendations, Brief review of capacity of urban roads.
Unit-III	**Traffic Control Devices:** Signs, Signals, markings and islands. Types of signs, Types of signals, Design of Signal, Intersections at grade and grade separated intersections. Types of grades separated intersections, Parking surveys: On street parking, off street parking.
Unit-IV	**Road safety audit**: RSA team, RSA Report, Elements of RSA, and Detrimental effects of traffic. Vehicular air pollution and Situation in India, Motor vehicle act, Vehicular emission norms in India and abroad. Alternate fuels. Factors affecting fuel consumption.

Suggested Readings

- Principles of Transportation Engineering by Chakraborty& Das, Prentice Hall, India.
- Highway Eng. by S.K.Khanna& C.E.G. Justo, Nem Chand Bros., Roorkee.
- Traffic Eng. and Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
- Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw
- HillPublishingCo. Ltd. N.Delhi.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Traffic Characteristics	https://www.youtube.com/watch?v=3XaTwQIugJ4
	Traffic Studies	https://youtu.be/0yzgMc110po?si=A3PZFpRSkvgcewNd
Unit-II	Traffic Accidents	https://youtu.be/VhuZ6M7a8N8?si=xRE5Z3HH408GvAmK
	Relationship between speed, volume and density	https://youtu.be/MOxya1UVxgc?si=MFcIHslh7lzyo6E6
Unit-III	Traffic Control Devices	https://youtu.be/eiKvXIpRVq8?si=L3SJM2YSXONsrhiz
	Design of Signal	https://youtu.be/-cqxQepo01o?si=9dP_TvQItknLXZu8
Unit-IV	Road safety audit	https://youtu.be/qRJ_ayWjn04?si=HhQTtflUfrvDEWJV
	Motor vehicle act	https://www.youtube.com/live/C2AD3wFAuy0?si=4iy77sZeLzeAVvkf

Course Code	**PEC-CE-325A**				
Category	**Professional Elective Course**				
Course Title	**Engineering Geology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To provide fundamental knowledge of geology, minerals, rocks, and geological processes relevant to civil engineering. • To develop skills for map interpretation, rock analysis, and evaluation of geological conditions in engineering projects and hazards.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of geology, minerals, rocks, and earth structure**.**	Level 1: Remember
CO2	Understand geological processes like weathering, erosion, petrology, and structural geology.	Level 2: Understand
CO3	Apply geological knowledge to map interpretation, identification of minerals/rocks, and engineering evaluation of rock properties**.**	Level 3: Apply
CO4	Analyze geological conditions in civil engineering projects (dams, slopes, earthquakes) and assess hazards with suitable measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1 : Introduction**: Scope, Subdivision of Geology, Interior of Earth, Importance of Geological Studies in Various Civil Engineering Projects, Department Dealing with this Subject in India and their Scope of Work- GSI, Granite Dimension Stone Cell, NIRM; Use of Geological Maps and Interpretation of Data. **Module 2: Physical Geology**: External and Internal Geological Forces Causing Changes; Weathering, Erosion and Denudation of the Surface of the Earth; Factors Affecting Weathering and Product of Weathering; Superficial Deposits and its Geotechnical Importance: Water Fall and Gorges, River Meandering, Alluvium, Glacial Deposits, Desert Landform, Loess, Mudflows, Coastal Deposits.
Unit-II	**Module 3 : Mineralogy** : Origin and Composition of Minerals, Physical Properties of Minerals, Susceptibility of Minerals to Alteration, Rock Forming Minerals, Megascopic Identification of Common Primary and Secondary Minerals. **Module 4 : Petrology**: Rock Formation Processes, Ternary Diagram, Igneous Petrology- Volcanic Phenomenon, Types of Volcanic Eruption, Chemical and Mineralogical Composition, Texture and its Types, Sedimentary Petrology- Mode of Formation, Mineralogical Composition, Texture and its Types; Metamorphic Petrology- Agents and Types

	of Metamorphism, Metamorphic Grades, Mineralogical Composition, Structures and Textures.
Unit-III	**Module 5: Structural Geology**: Forms and Structures of Rocks, Stress and Strain in Rocks, Deformation and Tectonics, Dip and Strike, Bedding Planes and Outcrops; Fold- Types and Nomenclature, Criteria for Their Recognition in Field; Faults: Classification, Recognition in Field. . **Module 6 : Properties of Rock Masses**: Sub Surface Investigations of Rocks and Engineering Characteristics of Rocks Masses; Field and Laboratory Tests on Rocks, Stress Deformation and Bearing Capacity of Rocks, Important Variables Influencing Rock Properties and Behaviour, Measurement of Velocity of Sound in Rock.
Unit-IV	**Module 7 : Geology of Dam and Reservoir**: Site Geological Consideration for Selecting Dam and Reservoir Site, Causes of Failure of Reservoir, Favourable and Unfavourable Conditions in Different Types of Rocks in Presence of Various Structural Features, Precautions to Counteract Unsuitable Conditions. **Module 8: Geological Hazards:** Rock Instability and Slope Movement; Concept of Sliding, Consequences of Land Sliding, Prevention by Surface Drainage, Slope Reinforcement by Rock Bolting and Rock Anchoring; Earthquake: Magnitude and Intensity of Earthquake, Seismic Waves; Seismic Zones in India.

Suggested Readings

- A textbook of Geology by P.K Mukherjee
- Physical and General Geology by SK Garg
- Engineering and General Geology by Prabin Singh.
- Introduction of physical Geology by A.holmes

Useful Video Links

Unit No.	Topic	Link
Unit-I	Scope, Subdivision of Geology	https://youtu.be/ksJpBG0R5pM?si=5cOmhlDq6Xb0awyf
	Weathering, Erosion and Denudation of the Surface of the Earth	https://youtu.be/GCiSOGweitU?si=ic3lArR5MbmJW8k3
Unit-II	Origin and Composition of Minerals	https://youtu.be/kVopWFgOcrU?si=f3pJdh4aNfhq2-DZ
	Sedimentary Petrology	https://www.youtube.com/live/ezqUycfNlzE?si=obAP9KAHLaAkI1Rz
Unit-III	Dip and Strike, Bedding Planes and Outcrops	https://youtu.be/WdBtwf3vl_0?si=y3aNj_0tu0CX2MBD
	Sub Surface Investigations of Rocks	https://youtu.be/ZLmqtF2FtkU?si=fs6mlkfDoktkC3cO
Unit-IV	Dam and Reservoir Site	https://youtu.be/bDwow2-WzHo?si=drnCdQXbKE1C8YEU
	Earthquake: Magnitude and Intensity of Earthquake	https://youtu.be/mWXpUo-_KOw?si=LPPrSZANDX9MDRCx

Course Code	**PCC-CE-302A**				
Course Category	**Professional Core Course**				
Course Title	**Irrigation Engineering And Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	**4**	
Course Objectives	The objectives of this course are: • To develop a comprehensive understanding of irrigation systems, crop water requirements, canal regulation works, cross drainage works, spillways, weirs, river training works, flood routing, dams, water logging and drainage, and • To apply, analyze, evaluate and integrate their design principles, hydraulic behaviour and functional performance for efficient and sustainable water resources and irrigation engineering solutions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall fundamental concepts of irrigation, water resources, and related structures.	Level 1: Remember
CO2	Explain crop water requirements, irrigation methods, and soil-water relationships.	Level 2: Understand
CO3	Apply principles of canal works, cross drainage works, and dam engineering in practical situations.	Level 3: Apply
CO4	Analyze the design and performance of spillways, river training works, and flood management systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Introduction to Irrigation:** Scope and Necessity of Irrigation, Water Resources and Irrigation Potential in India, Development of Irrigation, Irrigation Systems and their Classification, Benefits and Impacts of Irrigation, National Water Policy. **Module 2: Water Requirement of Crops & Methods of Irrigation:** Crop Seasons; Soil–Water–Plant Relationship; Field Capacity; Wilting Point; Consumptive Use; Evapotranspiration; Duty, Delta and Base Period; Irrigation Efficiencies; Frequency and Scheduling of Irrigation; Methods of Irrigation (Surface, Sprinkler and Drip Irrigation).
Unit-II	**Module 3: Canal Regulation Works:** Canal Alignment; Canal Losses**,** Canal fall – necessity and location, types of canal falls, Sarda type fall and its design, sloping glacis fall, cross regulator, distributory head regulator, silt control devices, canal escapes and their types, operation and maintenance of canals. **Module 4: Canal Outlets and Cross Drainage Works:** Requirements and Classification of Canal Outlets; Pipe Outlet; Adjustable Proportional Module (APM); Open Flume Outlet;

	Flexibility, Sensitivity and Proportionality of Outlets; Need and Classification of Cross Drainage Works; Aqueduct; Syphon Aqueduct; Super Passage; Canal Syphon; Level Crossing; Hydraulic Design Principles.
Unit-III	**Module 5: Spillways and Hydraulic Structures:** Need and types of spillways, design of ogee spillway**,** energy dissipaters and stilling basins. Need of weirs and barrages, components of weirs, Bligh's creep theory, Khosla theory, critical exit gradient and design of weirs. **Module 6: River Training Works and Flood Routing :** River Behaviour; Objectives and Classification of River Training Works; Guide Banks; Spurs; Marginal Embankments; Bank Pitching; Launching Apron; Meandering Rivers; Flood Routing (Hydrologic and Hydraulic Routing); Flood Control Measures.
Unit-IV	**Module 7: Gravity Dams:** Planning and Investigation of Dam Sites; Classification and Selection of Dams; Gravity Dams; Forces Acting on Gravity Dams; Stability Analysis; Modes of Failure; Elementary Profile of Gravity Dam. **Module 8: Earth Dams, Water Logging and Drainage:** Earth Dams; Components; Types; Seepage through Earth Dams; Phreatic Line; Kozeny Parabola; Filters and Drains; Causes and Control of Seepage; Water Logging; Land Reclamation; Surface and Subsurface Drainage.

Suggested Readings

- Chawla, K. K. (2017). *Irrigation Engineering and Hydraulic Structures*. Standard Publishers Distributors, New Delhi.
- Punmia, B. C., Pande, B. B., & Jain, A. K. (2016). *Irrigation Engineering and Water Power Engineering*. Laxmi Publications, New Delhi.
- Asawa, G. L. (2014). *Irrigation and Water Resources Engineering*. New Age International Publishers.
- Garg, S. K. (2017). *Irrigation Engineering and Hydraulic Structures*. Khanna Publishers, New Delhi.
- Varshney, R. S., Gupta, S. C., & Gupta, R. L. (2015). *Theory and Design of Irrigation Structures*. Nem Chand & Bros.
- Arora, K. R. (2013). *Irrigation, Water Power and Water Resources Engineering*. Standard Publishers Distributors.
- Central Water Commission (CWC). (Latest Edition). *Manuals and Guidelines for Irrigation and Hydraulic Structures*. Government of India.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction	https://youtu.be/ibzY0LjHu38
	Crop water requirement	https://youtu.be/e7pckUDQ9oI
Unit-II	Design of Sarda type Fall	https://youtu.be/REK--iUi_xE
	Canal Outlets	https://youtu.be/ps8HUDWU1fg
Unit-III	Design of aqueducts	https://youtu.be/iJzuYlCZzTU
	Design of ogee spillway	https://youtu.be/QIJ6Rb8wz80
Unit-IV	Methods of River training	https://youtu.be/LmE-9TId6Wk
	Water logging	https://youtu.be/0i896NelJ3A

Course Code	**PCC-CE-304A**				
Course Category	**Professional Core Course**				
Course Title	**Foundation Engineering - I**				
Scheme and Credits	L	T	P	**Credit**	**Semester VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are: • To develop understanding of earth pressure theories and their application in retaining structures. • To study slope stability concepts and methods for analyzing slope failures. • To introduce the principles of shallow foundation design and bearing capacity analysis.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the concepts of lateral earth pressure, slope stability, bearing capacity, and soil exploration methods.	Level 1: Remember
CO2	Explain earth pressure theories, slope failure mechanisms, and shallow foundation behavior under various loading conditions.	Level 2: Understand
CO3	Apply bearing capacity theories and site investigation methods for the analysis and design of shallow foundations.	Level 3: Apply
CO4	Analyze slope stability, retaining structures, and foundation performance for geotechnical engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Earth Pressure Theories:** Lateral Earth Pressure, At-rest earth pressure, Active earth pressure, Passive earth pressure, Rankine's Theory, Cohesionless backfill, Cohesive backfill, Coulomb's Theory, Wall friction effects, Inclined backfill, Earth Pressure Diagrams, Retaining wall applications.
Unit-II	**Stability of Slopes:** Types of Slopes, Infinite slopes, Finite slopes, Slope Failure Mechanism, Rotational failure, Translational failure, Stability Analysis, Swedish circle method, Bishop's simplified method, Taylor's stability number, Factor of Safety, Stability charts.
Unit-III	**Shallow Foundations:** Types of shallow foundations, Bearing Capacity Theories, Terzaghi's bearing capacity theory, Meyerhof theory, Hansen theory, Vesic theory, Bearing Capacity Factors, Shape factors, Depth factors, Inclination factors, Effect of Water Table Corrections in bearing capacity, Settlement of Foundations, Settlement in clay Settlement in sand.
Unit-IV	**Site Investigation & Soil Exploration:** Subsurface Investigation, Objectives of exploration, Methods of Exploration, Open pits, Borings, Wash boring, Rotary drilling, Sampling Techniques,

	Disturbed samples, Undisturbed samples, In-situ Tests, Standard Penetration Test (SPT), Cone Penetration Test (CPT), Plate Load Test, Vane Shear Test, Geophysical Methods, Seismic refraction, Electrical resistivity.

Suggested Readings

1. Das, B. M. (2015). Principles of geotechnical engineering (9th ed.). Cengage Learning.
2. Ranjan, G., & Rao, A. S. R. (2016). Basic and applied soil mechanics (3rd ed.). New Age International Publishers.
3. Punmia, B. C., Jain, A. K., & Jain, A. K. (2017). Soil mechanics and foundations (17th ed.). Laxmi Publications.
4. Budhu, M. (2015). Soil mechanics and foundations (3rd ed.). Wiley.
5. Terzaghi, K., Peck, R. B., & Mesri, G. (1996). Soil mechanics in engineering practice (3rd ed.). Wiley.
6. Holtz, R. D., Kovacs, W. D., & Sheahan, T. C. (2011). An introduction to geotechnical engineering (2nd ed.). Pearson Education.

Useful Video Links

Unit No.	TOPIC	Link
Unit-I	Earth Pressure Theories	https://youtu.be/pH7Ly8KCR3E?si=WMWi6oZ_ZaqK6kAZ
Unit-II	Stability of Slopes	https://youtu.be/e8WUMP6Rt94?si=JtufcWJJtHM-G9Qv
Unit-III	Shallow Foundations	https://youtu.be/lsYFtwwlHIw?si=h0olF1s3zcuaZQYp
Unit-IV	Site Investigation & Soil Exploration Subsurface	https://youtu.be/P0j_pt4BLS0?si=FNGA2HcUua8OK_1N

Course Code	**PCC-CE-306A**				
Course Category	**Professional Core Course**				
Course Title	**Highway Engineering - II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To understand the principles of design, construction, and performance of flexible and rigid pavements. • To apply standard methods (IRC, CBR, AASHTO) for pavement design, evaluation, and strengthening. • To analyze pavement failures, drainage, and economic aspects for efficient highway engineering.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of pavement types, components and materials.	Level 1: Remember
CO2	Explain design principles of flexible and rigid pavements.	Level 2: Understand
CO3	Apply IRC/CBR and AASHTO methods for pavement design and construction.	Level 3: Apply
CO4	Analyze pavement performance, failures and evaluation methods.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Design of Flexible Pavements:** Types of Pavement, Components of a Pavement and their Functions, Factors Effecting Design of Pavements, Review of Design by Old Methods, Design of a Flexible Pavement by CBR Method (as per Latest IRC Guidelines).Pavement Performance and its Methods- AASHTO and Asphalt **Module 2: Design of Rigid Pavements:** Westergaard's Theory and Assumption, Critical Locations of Loading, Load and Temperature Stresses, Critical Combination of Stresses, Joints: Types, Requirements and Patterns, Spacing of Expansion and Contraction Joints; Design and Functions of Dowel and Tie Bars, IRC and AASHTO Methods of Rigid Pavement Design.
Unit-II	**Module 3: Construction of Bituminous Pavements:** Various Types of Bituminous Constructions, Prime Coat, Tack Coat, Seal Coat and Surface Dressing; Construction of BUSG, Premix Carpet, BM, DBM and BC, Mastic Asphalt, Functions of Rollers, Paver and Hot Mix Plants, Introduction to Various IRC and MORTH Specifications **Module 4: Highway Construction:** Non-Bituminous Pavements Subgrade and Embankment construction, Construction of GSB, WBM, WMM; Construction of DLC and PQC, Fixed Form and Slip-Form Paving Techniques

Unit-III	**Module 5: Pavement Failure and Remedies:** Classification of Distresses in Pavements (Functional and Structural); Different Types of Distresses in Flexible and Rigid Pavements along with the Causes and Remedial Measures; Various Types of Maintenance of Pavements; Evaluation of Pavements: Functional and Non- Destructive Evaluation. **Module 6: Strengthening of Existing Pavement:** Objective of Strengthening, Different Types of Overlay, Design of Flexible Overlays on Flexible Pavement using Effective Thickness Approach and Deflection Approach, Benkelman Beam Method, Design of Other Types of Overlays.
Unit-IV	**Module 7: Highway Drainage and Hill Roads:** Necessity and Significance of Drainage, Mode of Ingress of Water in Highway Structure, Surface Drainage: -Types and Brief Design, Types of Sub-Surface Drainage, Drainage Inkling for the Roads in Hilly Areas, Special Characteristics of Hill Roads: Geometrics and Hair Pin Bends. **Module 8: Highway Economics and Finance :** Need of Economic Evaluation, Highway User Benefits and Costs, Methods of Economic Evaluation, Highway Finance, PPP Projects, Rate Analysis of MORTH-Standard Data Book and Cost Estimation

Suggested Readings:

- Highway Engg by S.K.Khanna & C.E.G. Justo, Veeraragavan A., Nem Chand Bros., Roorkee,2014.
- Principles and Practice of Highway Engg. By L.R.Kadiyali, N.B. Lal,Khanna Publishers, Delhi,2008.
- Principles of Pavement Design by Yoder,E.J & Witczak,M.W., John Wiley and Sons, USA.
- Tunnel Engineering by S.C.Saxena, Dhanpat Rai Publications, N.Delhi.
- A text book of Tunnel, Bridges and Railway Engg. By S.P. Bindra, Dhanpat Rai Delhi

Useful Video Links

Unit No.	Topic	Link
Unit I	Design of Flexible Pavements (CBR Method as per IRC)	https://youtu.be/9BL6rl6hPQ0?si=VNJW3MmXBSJa805z
	Design of Rigid Pavements (Westergaard Theory)	https://youtu.be/AJLAFAOcSlM?si=esuTiHkjKJu5F82I
Unit II	Construction of Bituminous Pavements	https://youtu.be/Ky-z2QRe_eU?si=0bHJvkpoApKKyxex
	Construction of Non-Bituminous Pavements	https://youtu.be/smPaOcM1Xc8?si=fP0tBBlduEnmWyMn
Unit III	Pavement Failures and Maintenance Techniques	https://youtu.be/kKmG5qMZcAc?si=SYmeDnClbZs00ruh
	Pavement Strengthening and Overlay Design	https://youtu.be/cQMwDnnwWzk?si=GY01u9Z0MhrK7DF2
Unit IV	Highway Drainage and Hill Roads	https://youtu.be/O2hHrg6DH8k?si=av7M5RBHhvZdj9aO
	Highway Economics and Finance	https://youtu.be/zAwa2_BTu_Q?si=WpiWvoZc4W53zdnv

Course Code	**PCC-CE-308A**				
Course Category	**Professional Core Course**				
Course Title	**Waste Water Treatment**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To learn basics of sewage collection and design of sewers • To learn the basics of sewage composition and its characteristics • To have adequate knowledge about various sewage treatment processes and its design • To provide adequate information on various disposal standards for treated effluents				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the fundamental concepts of sanitation, sewerage systems, wastewater characteristics, and design terminology.	Level 1: Remember
CO2	Explain the principles of sewer design, house drainage, wastewater treatment processes, and sludge treatment methods.	Level 2: Understand
CO3	Apply engineering principles for the design and analysis of sewerage systems and wastewater treatment units.	Level 3: Apply
CO4	Analyze wastewater treatment, sludge disposal, and reuse strategies for sustainable environmental sanitation and pollution control.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Module 1: Introduction:** Importance and Necessity of Sanitation, Terms used in sanitation- Sullage, Sewage, Sewer and Sewerage, Sewerage Systems and their Suitability, Dry Weather Flow, Factors Affecting Dry Weather Flow, Flow Variations and their Effects on Design of Sewerage System. **Module 2: Design of Sewers:** Types of Sewers and their Hydraulic Design, Material used for Sewer Construction, Joints and Sewer Appurtenances, Layout, Construction and Testing of Sewer Lines, Velocity in Sewers, Storm Water Sewers.
Unit-II	**Module 3: House Drainage:** Principles of House Drainage, Types of Pipes used for Drainage, Classification and Functions of Traps, Sanitary Fitting, System of Plumbing, House Drainage Plan and Ventilation of House Drainage. **Module 4: Wastewater Characteristics:** Quality Parameters- Physical, Chemical and Biological Characteristics, Oxygen Demand, Indian Standards for Disposal of Effluents into Inland Surface Sources and on Land, Guidelines for Reuse of Treated Wastewater.

Unit-III	**Module 5: Primary Sewage Treatment:** Objectives, Flow chart of Conventional Treatment Units and their Efficiencies, Preliminary Treatment, Screening and Grit Removal Units, Principle, Types and Design of Primary Sedimentation Tank, Coagulation Aided Sedimentation Tank, Flocculation. **Module 6: Secondary Sewage Treatment:** Concept of Organic Matter Removal, Aerobic and Anaerobic Treatment Processes, Activated Sludge Process, Conventional and Extended Aeration Systems, Trickling Filters, Aerated Lagoons, septic tank, Waste Stabilization Ponds, Oxidation Ditches, Up-Flow Anaerobic Sludge Blanket Process.
Unit-IV	**Module 7: Sludge Treatment:** Objectives, Sludge Digestion, Digestion and Disposal of Primary and Secondary Sludge, Factors Affecting Sludge Digestion, Thickening of Sludge, Anaerobic Digestion of Sludge, Sludge Digestion Tank, Sludge Conditioning and Dewatering, Sludge Drying Bed. **Module 8: Sludge Disposal:** Standards of Wastewater Disposal, Modes of Disposal of Treated Sludge, Self-Purification of Streams, Oxygen Sag Curve, Sewage Farming, Sodium Hazards, Soil Dispersion System.

Suggested Readings

- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Wastewater Engineering, Collection, Treatment and Disposal: Metcalf and Eddy
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie
- Sewage and Sewage Treatment: S.K. Garg.
- Sewage and Sewage Treatment: S.R. Krishansagar.
- Waste Water Engineering: B.C. Punmia.
- Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Importance and Necessity of Sanitation	https://youtu.be/3J7n_2_6iCw?si=j_uIAsYT357zkugP
	Dry Weather Flow	https://youtu.be/CgHmPXrBeCM?si=nC32d4teYFsmz75X
II	House Drainage	https://youtu.be/oPKyZCbK1Pc?si=EVmOd5p2GLxTWnSb
	Wastewater Characteristics	https://youtu.be/wwSetkwdiMc?si=RF5VRbTD30Xk9Zrr
III	Primary Sewage Treatment	https://youtu.be/S2hF1AqelJg?si=Q0yplxvoNvskeVjg
	Concept of Organic Matter Removal	https://youtu.be/5qR5d1uQnd8?si=9NQihqYBACJXYGA0
IV	Objectives, Sludge Digestion	https://youtu.be/zXqnDzqJPsE?si=gHKIVz4VAPV-IQ2y
	Sewage Farming	https://youtu.be/JWtciKYJou4?si=5MTxbJjbVP8lmp8Q

Course Code	**LC-CE-310A**				
Category	**Lab Course**				
Course Title	**Foundation Engineering lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are: • To develop the ability to understand and apply soil testing methods. • To analyze laboratory and field data • To evaluate engineering properties of soils for geotechnical design and foundation assessment.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall basic concepts of soil properties and testing methods used in geotechnical engineering.	Level 1: Remember
CO2	Explain the principles of hydrometer analysis, relative density, shrinkage limit, triaxial, and consolidation tests.	Level 2: Understand
CO3	Perform laboratory and field tests to determine shear strength, consolidation, and bearing capacity parameters of soils.	Level 3: Apply
CO4	Analyze and interpret test results for assessing soil behavior and foundation suitability.	Level 4: Analyze

List of Experiments

1. To determine grain size analysis using Hydrometer method.
2. To determine relative density of granular Soils.
3. To determine shrinkage limit of fine grained soil.
4. To determine shear strength properties for consolidated drained conditions using Triaxial test.
5. To determine shear strength properties for consolidated undrained condition using Triaxial test.
6. To determine consolidation parameters using consolidometer.
7. To determine bearing capacity parameters using Standard Penetration Test.
8. Demonstration of Undisturbed Sampling.
9. Demonstration of cone penetration test.
10. To study of Model Plate Load Test.

Useful Video Links

Exp. No	**Topic**	**Link**
1	Grain Size Analysis using Hydrometer Method	https://youtu.be/zVmK5bvsbZ8?si=D_69eXdHnUA_OIqJ

2	Relative Density Test of Granular Soils	https://youtu.be/9uZgZxRCDYE?si=bsonTb3Gx056cyYh
3	Shrinkage Limit Test of Fine Grained Soil	https://youtu.be/t4FZ4J4pHUA?si=WZwDiFP_oRjub9vy
4	Triaxial Test (Consolidated Drained Condition)	https://youtu.be/uW-6acy5-fU?si=ITHR4SNriZCnXdB-
5	Triaxial Test (Consolidated Undrained Condition)	https://youtu.be/nwFxK2gPmik?si=quJcyr5RoQtuoz93
6	Consolidation Test using Consolidometer	https://youtu.be/DGEzIKBbz5M?si=07KxC_SFgwHYHHZ7
7	Standard Penetration Test (SPT)	https://youtu.be/duLjQsKfstM?si=4dytvA2api9vqFMR
8	Demonstration of Undisturbed Sampling	https://youtu.be/XiMOTe_YZaw?si=UKJP_C0DgdNBru3Y
9	Cone Penetration Test (CPT) Demonstration	https://youtu.be/ujDEhBroPo8?si=6VYBRhQB1WHuIp3p
10	Model Plate Load Test	https://youtu.be/TXyuxcfJFS8?si=mjybyDUfWBylmjj

Course code	**LC-CE-312A**				
Category	**Lab Course**				
Course title	**Highway Engineering-II Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives:	The objectives of this course are: • To understand the properties and behavior of bituminous materials used in pavements. • To perform standard laboratory tests and mix design procedures. • To evaluate and analyze pavement materials for suitability and performance.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall the testing procedures and standards related to bituminous materials, aggregate	Level 1: Remember
CO2	Explain the engineering properties of bituminous binders and pavement materials	Level 2: Understand
CO3	Perform laboratory tests for mix design and evaluation of bituminous and concrete pavement materials	Level 3: Apply
CO4	Analyze laboratory results to assess pavement material suitability and design performance for highway construction applications.	Level 4: Analyze

List of Experiments

1. To determine the flash and fire point of bituminous material.
2. To determine the softening point of paving bitumen.
3. To determine the specific gravity of bituminous material.
4. To determine ductility of bitumen.
5. To determine the hardness of bitumen.
6. To determine the grade of a given binder.
7. To determine the viscosity of bituminous material.
8. To determine the granular mix design.
9. To determine the bituminous mix design by Marshall's method.
10. To determine the cement concrete mix design for pavements.
11. Demonstration of BBD & Bump Integrator.

Reference Books:

- Khanna, S.K. and Justo, C.E.G., Veeraragavan A., "Highway Engineering", Nem Chand &Bros.
- Khanna, S.K. and Justo, C.E.G., "Highway Material Testing Manual", NemChand& Bros.
- Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.

Useful Video links:

Virtual Lab :https://ts-nitk.vlabs.ac.in/List%20of%20experiments.html

Exp. No	Topics	Links
1	Flash and Fire Point Test of Bituminous Material	https://youtu.be/s5OnzI0B2vY?si=oB_wmCzv5TtmSIoS
2	Softening Point Test of Paving Bitumen	https://youtu.be/WkJuGGGmYhQ?si=qRcKYv0AsLG_vUzG
3	Specific Gravity Test of Bituminous Material	https://youtu.be/o1BgC0em2X0?si=6pNX5oq_oJnf1Bnf
4	Ductility Test of Bitumen	https://youtu.be/TE8zYxUJHt0?si=fMfKBxeuVmiC_b6v
5	Penetration/Hardness Test of Bitumen	https://youtu.be/9HZE6DNfF5U?si=KnyI_oj10hJcnM7_
6	Determination of Bitumen Binder Grade	https://youtu.be/CRopmpsDyBQ?si=oXlfwwFkpAX9ekdC
7	Viscosity Test of Bituminous Material	https://youtu.be/TE8zYxUJHt0?si=WivAIovjdr8cXUup
8	Granular Mix Design	https://youtu.be/BYxWW_3YnOA?si=nqICmctRc_qljmC
9	Marshall Mix Design Method	https://youtu.be/zMgLPRnwDAk?si=nO-CIzRvGeH5aNw7
10	Cement Concrete Mix Design for Pavements	https://youtu.be/VBrP_vm2YsA?si=XeXhpf-_SpUZXokv
11	Demonstration of BBD and Bump Integrator	https://youtu.be/MAaSolK_qSU?si=ZaZNSGAJ0JnNhBYQ

Course code	**LC-CE-314A**				
Category	**Lab Course**				
Course title	**Environmental Engineering Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives:	The objectives of this course are: • To quantify the water and wastewater pollutant. • To analyze the physical characteristics of water and wastewater. • To analyze the chemical characteristics of water and wastewater				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall standard laboratory procedures and water quality parameters.	Level 1: Remember
CO2	Explain the significance of physical, chemical, and biological characteristics of water and wastewater.	Level 2: Understand
CO3	Perform laboratory tests for assessment of water and wastewater quality using standard methods.	Level 3: Apply
CO4	Analyze experimental results to evaluate water quality and recommend suitable treatment measures for environmental applications.	Level 4: Analyze

List of Experiments

1. Determination of Turbidity of water by using suitable method
2. Determination of pH of given water sample.
3. Determination of Hardness of given water sample.
4. Determination of Residual Chlorine in given sample of water
5. Determination of Total Suspended and Dissolved Solids in given water sample.
6. Determination of Bio –chemical oxygen demand of waste water sample.
7. Determination of chemical oxygen demand of waste water sample.
8. Determination of Conductivity of given water sample.
9. Determination of Chlorides of given water sample
10. Determination of Alkalinity and Acidity of a given water sample.
11. Determination of Dissolved Oxygen of given waste water sample.

Useful Video links:

Exp. No	Topics	Links
1	Determination of Turbidity of Water	https://youtu.be/LeKqhMqEoKQ?si=CsWPx14nfp9ayYAi

2	Determination of pH of Water Sample	https://youtu.be/3gHqji3inmc?si=WhAo28tgLABuHWdC
3	Determination of Hardness of Water	https://youtu.be/FCQ26RQBZLg?si=EtxK4z7kpZtiN7w8
4	Determination of Residual Chlorine	https://youtu.be/zelRO_lmDdc?si=VkyJVH4jna3gh8d4
5	Determination of Total Suspended and Dissolved Solids	https://youtu.be/ojjna1xtVzQ?si=24Vm9paqWh7hn32_
6	Determination of Biochemical Oxygen Demand (BOD)	https://youtu.be/sSPtpGguO5A?si=nybLfxkvw0M1hwfF
7	Determination of Chemical Oxygen Demand (COD)	https://youtu.be/1kd18-L8c3o?si=dAc0uAEW1qBOv7U3
8	Determination of Conductivity of Water	https://youtu.be/9gzMc9UQAe4?si=z9W28GpzJDpCwIS1
9	Determination of Chlorides in Water Sample	https://youtu.be/2kSJPyMspAo?si=YaXt_AlI-pHx5zFa
10	Determination of Alkalinity and Acidity	https://youtu.be/INFu8uMeRqw?si=9SpIhkTAaX3PTFj1
11	Determination of Dissolved Oxygen (DO)	https://youtu.be/Rf7ByPaUmuM?si=5quxsoskjZbRGzut

Course code	**LC-CE-316A**				
Category	**Lab Course**				
Course title	**Structural Analysis and Design Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives:	The objectives of this laboratory are: •To familiarize students with STAAD.Pro for structural modeling, analysis, and design. •To develop skills in analyzing RCC, steel, and composite building structures. •To enable students to apply relevant IS codes in structural design. •To provide hands-on experience in computer-aided building analysis and design.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall the features, commands, and workflow of STAAD.Pro.	Level 1: Remember
CO2	Explain the structural behavior of building components using analysis results.	Level 2: Understand
CO3	Apply STAAD.Pro for modeling, analysis, and design of RCC, steel, and composite structures.	Level 3: Apply
CO4	Analyze the performance of multi-storey building structures under gravity, wind, and seismic loads.	Level 4: Analyze

List of Experiments

- Introduction to STAAD.Pro interface, structural modeling, load assignment, analysis, and interpretation of results.
- Modeling and analysis of RCC beams and continuous beams used in building structures.
- Modeling and analysis of RCC columns and beam-column frames under gravity loads.
- Modeling and analysis of a G+1 RCC building under dead and live loads.
- Modeling and analysis of a multi-storey RCC building under gravity loads.
- Analysis of multi-storey RCC buildings subjected to wind loads as per IS 875.
- Analysis of multi-storey RCC buildings subjected to earthquake loads as per IS 1893.
- Design of RCC beams, columns, and footing reactions using STAAD.Pro as per IS 456.
- Modeling, analysis, and design of steel building frames using STAAD.Pro as per IS 800.
- Modeling, analysis, and design of RCC–Steel hybrid (composite) building structures under gravity, wind, and seismic loads.
- Mini Project: Analysis and design of a residential multi-storey RCC building using STAAD.Pro.

Useful Video links:

Exp. No	Topics	Links
1	Introduction to STAAD.Pro interface, modeling, load assignment, and analysis	STAAD.Pro Introduction and Basics

2	Modeling and analysis of RCC beams and continuous beams	STAAD.Pro RCC Beam Analysis Tutorial
3	Modeling and analysis of RCC columns and beam-column frames	STAAD.Pro Frame Analysis Tutorial
4	Modeling and analysis of a G+1 RCC building	STAAD.Pro RCC Building Design Part-1
5	Modeling and analysis of a multi-storey RCC building	STAAD.Pro RCC Building Design Part-2
6	Analysis of multi-storey RCC buildings under wind loads	STAAD.Pro Wind Load Analysis Tutorial
7	Analysis of multi-storey RCC buildings under earthquake loads	STAAD.Pro Seismic Analysis Tutorial
8	Design of RCC beams, columns, and footing reactions	STAAD.Pro RCC Design Tutorial
9	Modeling, analysis, and design of steel building frames	STAAD.Pro Steel Structure Design Tutorial
10	Modeling, analysis, and design of RCC–Steel hybrid structures	STAAD.Pro Composite Structure Design Tutorial
11	Mini Project: Residential multi-storey RCC building design	Complete RCC Building Design using STAAD.Pro

Course Code	**PEC-CE-318A**				
Category	**Professional Elective Course**				
Course Title	**Advanced Steel Structures**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are: ● To impart practical knowledge of advanced steel structures and their application. ● To teach the students advance level design of steel structures. ● To make the students familiar with the relevant IS codes to be used in construction industries. ● To teach the students modern design methods such as design of light gauge steel.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the concepts of eccentric connections, cold-formed sections, industrial steel structures, and design provisions.	Level 1: Remember
CO2	Explain the behavior and design principles of advanced steel structural components such as towers, water tanks, stacks, and plate girders.	Level 2: Understand
CO3	Apply codal provisions and design procedures for advanced steel structural systems and their connections.	Level 3: Apply
CO4	Analyze and design complex steel structures including gantry girders, industrial buildings, towers, and special steel components for engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Module 1: Eccentric and Moment Connections:** Beams-Column Connections, Connections Subjected to Eccentric Shear, Bolted Framed Connections, Bolted Seat Connections, Bolted Bracket Connections. Bolted Moment Connections, Welded Framed Connections, Welded Bracket Connections and Moment Resistant Connections. **Module 2: Cold Formed Sections:** Brief description of various types of cold-formed sections, local buckling, concepts of effective width and effective sections, elements with stiffeners, Design of compression and bending elements.
Unit-II	**Module 3: Industrial Buildings:** Loads, general arrangement and stability, design considerations, design of Purlins, design of roof trusses, industrial building frames, bracings and stepped columns.

	Module 4: Towers: Transmission line towers, Microwave towers, Design loads, classification, Design and specification.
Unit-III	**Module 5: Design of Water Tanks:** Types of water tank, permissible stresses, design of circular, rectangular and pressed steel tanks including staging. **Module 6: Design of Steel Stacks:** Types of steel stack, various loads consideration of steel stacks, Design of steel stacks including foundation.
Unit-IV	**Module 7: Plate Girder:** Elements of plate girder, Design steps of a plate girder, necessity of stiffeners in plate girder, various types of stiffeners, web and flange splices, Curtailment of flange plates, Design beam to column connections: Introduction, design of framed and seat connection. **Module 8: Design of Gantry Girder:** Loading Consideration, Selection Criteria of Gantry Girder, Specification, Design of Gantry girder

Suggested Readings

- Design of steel structures, A.S. Arya & J.L. Ajmani, Nemchand & Bros., Roorkee.
- Design of steel structures (LSM), N. Subramanian, Oxford Publication.
- Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
- Design of steel structures, S.M.A. Kazmi & S.K. Jindal, Prentice Hall, New Delhi.
- Design of steel structures, S.K. Duggal, TMH Pub, New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Beams-Column Connections	https://youtu.be/3oMMA5gwQ_o?si=b1BpWFBDG9qCHjTi
	Cold Formed Sections	https://www.youtube.com/live/ntIY4fffnBo?si=bfoSItDJoFtptXVy
II	Industrial Buildings	https://youtu.be/jcZ-mEUyBzQ?si=E2Ft3m5Qw9lutdQy
	Transmission line towers	https://youtu.be/XKNAhSCL7A4?si=J2jFgqRKm-OJh5Ti
III	Types of water tank	https://youtu.be/Kds06g-_93Q?si=4o5COnURV-f6ekx4
	Types of steel stack	https://youtu.be/yuZ17yBbkj0?si=GSeZGtqL3O6Yslw5
IV	Elements of plate girder	https://youtu.be/xsgtuNXmmvc?si=3ZEaKYSkm2V9Vvq1
	Loading Consideration	https://youtu.be/ElKIIbv9kE4?si=wVkRnFyxmsWhrMFu

Course Code	**PEC-CE-320A**				
Category	**Professional Elective Course**				
Course Title	**Pre-Stressed Concrete**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students. • To the design of pre-stressed concrete structures subjected to flexure and shear. • To make them familiar with design of typical pre-stressed concrete structural elements and to have a knowledge of the codal provisions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the fundamental concepts of prestressing systems, material properties, and losses of prestress in concrete members.	Level 1: Remember
CO2	Explain the behavior of prestressed concrete members under shear, torsion, deflection, cracking, and serviceability conditions.	Level 2: Understand
CO3	Apply analytical and design principles for prestressed concrete members subjected to axial load, flexure, shear, and torsion.	Level 3: Apply
CO4	Analyze and design advanced prestressed concrete systems including composite beams, continuous beams, and miscellaneous prestressed structures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Module 1: Material Properties and Prestressing Systems:** Introduction of Prestressing system-history, types, source, advantages and its limitations, Prestressing Systems and Devices. Materials properties- Constituents of Concrete and their Properties, Stress-Strain Curves for Concrete, Constituents of Prestressing Steel and their Properties, Types of Prestressing Steel, Stress-Strain Curves for Prestressing Steel, Relaxation of Steel, Fatigue, Codal Provisions. **Module 2: Losses in Prestress:** Elastic Shortening, Pre-Tensioned & Post-Tensioned - Axial & Bending Members, Losses in Prestress - Friction, Anchorage Slip, Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Total Time-Dependent Loss, Force Variation Diagram**.**
Unit-II	**Module 3: Analysis and Design for Shear and Torsion:** Introduction, Types of Cracks, Components of Shear Resistance and Pure Torsion, Modes of Failure, Effect of Prestressing Force, Stress in an Uncracked Beam, Design and Detailing Requirement for Shear, Design of Longitudinal Reinforcement and Transverse Reinforcement.

	Module 4: Calculations of Deflection and Crack Width: Factors Influencing Deflections, Short Term Deflections of Uncracked Members, Prediction of Long Term Deflections due to Creep and Shrinkage, Check for Serviceability Limit State of Deflection. Deflection due to Gravity Loads and Prestressing Force, Total Deflection, Determination of Moment of Inertia, Calculation of Crack Width, Method of Calculation, Limits of Crack Width.
Unit-III	**Module 5: Analysis of Members:** Analysis of Members under Axial and Flexural Load- Based on Stress, Force and Load Balancing Concept. Cracking Moment, Kern Point, Pressure Line, Analysis for Ultimate Strength, Variation of Stress in Steel Condition at Ultimate Limit State, Analysis of Rectangular Sections, Flanged Sections, Partially Pre-Stressed Sections, Un-Bonded Post-Tensioned Beams. **Module 6: Design of Members:** Design of Members for Axial Tension, Flexure Type I and Type II, Choice of Sections, Determination of Limiting Zone, Post-Tensioning in Stages, Magnel's Graphical Method, Guyon's Method
Unit-IV	**Module 7: Composite and Continuous Beams:** Analysis and Design of Composite Beams – Methods of Achieving Continuity in Continuous Beams, Analysis for Secondary Moments, Concordant Cable and Linear Transformation, Calculation of Stresses, Principles of Design. **Module 8: Miscellaneous Structures:** Design of Tension and Compression Members, Poles, Partial prestressing – definition, methods of achieving partial prestressing, merits and demerits of partial prestressing**.**

Suggested Readings

- Rajagopalan. N, "Prestressed Concrete", Narosa Publishing House, 2002.
- Dayaratnam. P., "Prestressed Concrete Structures", Oxford and IBH, 2013
- Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
- IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards,

Useful Video Links

Unit No.	Topic	Link
I	Material Properties	https://youtu.be/63-XoZ68jBo?si=YmlYPhbajlrQWrn5
	Losses in Prestress	https://youtu.be/AZoSeBRdEbg?si=gEuBd4rSlnftaS1l
II	Types of Cracks	https://youtu.be/gz1oEgECS9Q?si=xq8RtQ8cy_PmR_b9
	Factors Influencing Deflections	https://youtu.be/_nCKshanJN4?si=bPVEOy13QSmenbrg
III	Analysis of Members	https://youtu.be/LMH8aDqKJrE?si=b0eZF9_I8oPvzRZ2
	Design of Members	https://youtu.be/0ASvSbMgLP0?si=MnFOgAaVNfC-QQ9D
IV	Composite and Continuous Beams	https://youtu.be/Up4wUjuGvpo?si=UyQYJwfrjmXGP4_L
	Miscellaneous Structures	https://youtu.be/16P51olKuzk?si=6YXNPJjk_7L_EhyP

Course Code	**PEC-CE-322A**				
Category	**Professional Elective Course**				
Course Title	**Contracts Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the fundamentals, principles, and importance of contract management in construction projects. • To develop understanding of contract formation, administration, legal provisions, and contractual obligations. • To study contract execution, monitoring, risk management, and dispute resolution mechanisms.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the basic concepts, types, clauses, and legal framework of contract management.	Level 1: Remember
CO2	Explain contract formation, administration, performance monitoring, and contractual obligations in construction projects.	Level 2: Understand
CO3	Apply contract management principles for handling payments, variations, risk management, and contract execution in different project situations.	Level 3: Apply
CO4	Analyze contractual disputes, legal issues, risk factors, and closure procedures for effective contract management in engineering projects.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Module 1: Introduction & Basics:** Contract Management – Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management, Parties to a Contract, Types of Contracts. **Module 2: Contract Formation & Start-Up:** Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships, Planning and People-Resource Management.
Unit-II	**Module 3: Contract Clauses & Conditions:** Common Contract Clauses, Notice to Proceed, Rights and Duties of Various Parties, Notices to be Given, Contract Duration and Price, Performance Parameters. **Module 4: Time, Risk & Legal Conditions:** Delays, Penalties and Liquidated Damages, Force Majeure, Suspension and Termination, Changes & Variations, Notices under Contracts.
Unit-III	**Module 5: Contract Administration & Payments :** Contract Administration, Payments, Managing Performance, Monitoring and Measurement

	Module 6: Contract Management in Different Situations : Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods, Design, Supply and Installation Contracts, Contract Management in Consultancy
Unit-IV	**Module 7: Legal Framework & Dispute Resolution:** Various Acts Governing Contracts, Legal Aspects in Contract Management, Contract Management Legal View, Dispute Resolution, Conventional Dispute Resolution Methods, Alternative Dispute Resolution Methods, Integrity in Contract Management. **Module 8: Risk, Change & Closure:** Managing Risks, Managing Change, Contract Closure and Review, Ending a Contract, Post-Implementation Review.

Suggested Readings

- Construction Law – Informa Law.
- Project Procurement Management – Wiley.
- Managing and Administering the FIDIC Forms of Contract – Wiley Blackwell.
- The Indian Contract Act, 1872 – LexisNexis.
- Construction Claims and Responses – Wiley Blackwell.
- Indian Contract Act, 1872
- Arbitration and Conciliation Act, 1996
- FIDIC Contract Conditions Manuals.
- CPWD Works Manual and General Conditions of Contract.
- World Bank Procurement and Contract Guidelines for ICB/NCB Works.

Useful Video Links

Unit No.	Topic	Link
I	Contract Management	https://youtu.be/wDaltiUARU4?si=L98vzzZPSfTapjtN
	Contract Formation	https://youtu.be/t96A1DrsZTw?si=1cqvpQ5PbTkKrVD6
II	Common Contract Clauses	https://youtu.be/zHPm2MQlTHM?si=3Kb5OizJOPHClRmv
	Penalties and Liquidated Damages	https://youtu.be/E4Kfgtglmp8?si=_PLMUSxcjqVhlFby
III	Contract Administration	https://youtu.be/YsQu_WUw7Y0?si=Us3StzIcZ9-XIz9n
	Contract of Supply of Goods	https://youtu.be/UoZ8VmTr1eY?si=0ukMc8cw0nHahxry
IV	Various Acts Governing Contracts	https://youtu.be/t96A1DrsZTw?si=twwap530gofVDipn
	Managing Risks	https://youtu.be/zyet9fPS24k?si=d7KBj2E8e4pohcyr

Course Code	**PEC-CE-324A**				
Category	**Professional Elective Course**				
Course Title	**Hydro Power Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce energy systems and renewable energy resources • To explore society's present needs and future energy demands and then focus on alternatives, renewable energy sources. • To introduce basics of turbine and powerhouse.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamentals of energy sources, hydropower systems, and the basic components of hydropower plants.	Level 1: Remember
CO2	Explain the operating principles of hydropower stations, pump storage plants, intake structures, and water conveyance systems.	Level 2: Understand
CO3	Apply engineering principles for the analysis and design of penstocks, turbines, surge tanks, and hydropower plant components.	Level 3: Apply
CO4	Analyze hydropower plant layouts, operational performance, and system requirements for efficient power generation.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Introduction to Energy Sources:** Sources of energy, Status of hydropower, thermal vs. hydropower, advantages of hydropower, Energy contribution of hydropower in power system. **Module 2: Basics of Hydropower:** Electrical load on hydropower, load curves, load factor, capacity factors, utility factors and diversity factors, load on hydropower stations, load curves, load duration curves, firm power, secondary power, Prediction of loads.
Unit-II	**Module 3: Types of Hydropower Stations:** Elements of Hydro power, classification of hydropower stations, run of river plants, General layout of run of river plants, Valley dam plants, storage and pondage. **Module 4: Basic features of Pump Storage Plants:** Advantages of pump storage plants, types of pump storage plants, efficiency of pump storage plants, Reversible Turbines.
Unit-III	**Module 5: Intakes:** Intake structures: functions and their types, Components of intakes: forebay, trash racks, gates and valves, Force required to operate Gates. **Module 6: Water Conveyance System:** Classifications of Penstocks, Design criteria of penstocks, anchor blocks, types of valves, water hammer effects, instantaneous closure of power canal, Surge tank and its classification.

Unit-IV	**Module 7: Turbines:** Type of turbines, criteria for selection, specific speed of turbines, unit power, unit discharge, cavitations in turbines, Design of the draft tube. **Module 8: Power Houses:** General layout and arrangements of hydro-power units, number and size of units, substructure, spacing of units, super-structure, underground power stations.

Suggested Readings

- Water power Engineering by Dandekar and Sharma.
- Hydropower structures Volume III-By R S Varshney.
- Hydro Power Engineering by Dr Darde P N, Vayu Education,Delhi.
- Hydro-Electric Engineering Practice Vol.I, II& III Brown J.G.
- Water Power Engineering, Borrows, H.K.
- Water Power Development, Vol.I& II, Mosonyi,E.
- Water Power Engineering, M.M.Deshmukh.

Useful Video Links

Unit No.	Topic	Link
I	Sources of energy	https://youtu.be/583QHO5X1jo?si=inQMoDflbsR49U28
	Electrical load on hydropower	https://youtu.be/HSC-2gLtJX0?si=GW7UQxtRYUzEV1Ae
II	Elements of Hydro power	https://youtu.be/MSR7Acw_Q6U?si=ycnJKDjbkK2g9a8j
	Reversible Turbines	https://youtu.be/3BCiFeykRzo?si=KGI7kwlPCG0xk8Ml
III	Intake structures	https://youtu.be/RrtbXAqmyIo?si=MC00gqcAuPrgn1uF
	Classifications of Penstocks	https://youtu.be/CYJZbdzkofY?si=3LciS0cw6Osx4Seg
IV	Type of turbines	https://youtu.be/gOgKaCBlwX0?si=1Wr1pXWjg9XNTO0N
	underground power stations	https://youtu.be/x3oG5nbR6TM?si=GXnKs_ihIeckw_gK

Annexure AC/ 5.19

~~Annexure 4.4~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR (DELHI-NCR)
(AN AUTONOMOUS INSTITUTE)

Course Code	**OEC-02A**				
Category	**Open Elective Courses**				
Course Title	**Waste Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are : • To introduce the fundamentals of waste management and sustainable development. • To familiarize students with waste segregation, recycling and treatment methods. • To understand circular economy, resource recovery and waste-to-energy concepts. • To create awareness about environmental regulations and sustainable engineering practices.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Identify different types of waste and their environmental impacts.	Level 1: Remember
CO2	Explain waste management techniques.	Level 2: Understand
CO3	Apply sustainable waste management practices in engineering and society.	Level 3: Apply
CO4	Analyze sustainable waste management practices.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Fundamentals of Waste Management:** Introduction to waste management, Sources and classification of waste, Municipal, industrial, biomedical, e-waste, plastic and hazardous waste, Characteristics of waste, Environmental and health impacts, Waste management hierarchy (5R Concept), Sustainable Development Goals (SDGs).
Unit-II	**Waste Processing and Treatment:** Waste minimization, Segregation at source, Collection and transportation, Recycling of paper, plastic, metal and glass, Composting, Biomethanation, Incineration, Pyrolysis, Waste-to-Energy, Sanitary landfill, Resource recovery.
Unit-III	**Circular Economy and Emerging Technologies:** Circular economy principles, Zero waste concept, Extended Producer Responsibility (EPR), Plastic and e-waste management, Smart waste management systems, Digital tools for waste monitoring, Sustainable packaging, Carbon footprint reduction
Unit-IV	**Environmental Regulations and Sustainable Practices:** Solid Waste Management Rules, Plastic Waste Management Rules, E-Waste Management Rules, Biomedical Waste Management Rules, Green campus initiatives, Waste audit, Case studies on successful waste management, Role of engineers in sustainable waste management, Future trends.

Suggested Readings:

1. George Tchobanoglous, Hilary Theisen and Samuel A. Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw-Hill.
2. P. A. Vesilind, W. A. Worrell and D. R. Reinhart, Solid Waste Engineering, Cengage Learning.
3. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw-Hill.
4. M. N. Rao and H. V. N. Rao, Air Pollution, Tata McGraw-Hill. *(Selected chapters on solid waste and environmental pollution.)*
5. P. Venugopala Rao, Principles of Environmental Engineering, Prentice Hall of India.
6. Central Public Health and Environmental Engineering Organisation (CPHEEO), Manual on Municipal Solid Waste Management, Ministry of Housing and Urban Affairs, Government of India.
7. Central Pollution Control Board (CPCB), Guidelines on Solid Waste, Plastic Waste and E-Waste Management.
8. Ministry of Environment, Forest and Climate Change (MoEFCC), Solid Waste Management Rules, 2016, Plastic Waste Management Rules, 2016, E-Waste Management Rules, 2022, and subsequent amendments.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Fundamentals of Waste Management	Municipal Solid Waste Management (NPTEL - IIT Guwahati)
	Introduction	NPTEL Course Portal – Municipal Solid Waste Management
UNIT-II	Waste Processing & Treatment	Integrated Waste Management for a Smart City (NPTEL - IIT Kharagpur)
	Processing Technologies	Municipal Solid Waste Management (NPTEL Archive)
UNIT-III	Circular Economy & Sustainable Waste Management	Integrated Waste Management for a Smart City (NPTEL - IIT Kharagpur)
UNIT-IV	Environmental Regulations & Case Studies	Municipal Solid Waste Management (NPTEL - IIT Guwahati)

Annexure 4.4

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR (DELHI-NCR)
(AN AUTONOMOUS INSTITUTE)

Course Code	**OEC-02A**				
Category	**Open Elective Courses**				
Course Title	**Waste Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are : • To introduce the fundamentals of waste management and sustainable development. • To familiarize students with waste segregation, recycling and treatment methods. • To understand circular economy, resource recovery and waste-to-energy concepts. • To create awareness about environmental regulations and sustainable engineering practices.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Identify different types of waste and their environmental impacts.	Level 1: Remember
CO2	Explain waste management techniques.	Level 2: Understand
CO3	Apply sustainable waste management practices in engineering and society.	Level 3: Apply
CO4	Analyze sustainable waste management practices.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Fundamentals of Waste Management:** Introduction to waste management, Sources and classification of waste, Municipal, industrial, biomedical, e-waste, plastic and hazardous waste, Characteristics of waste, Environmental and health impacts, Waste management hierarchy (5R Concept), Sustainable Development Goals (SDGs).
Unit-II	**Waste Processing and Treatment:** Waste minimization, Segregation at source, Collection and transportation, Recycling of paper, plastic, metal and glass, Composting, Biomethanation, Incineration, Pyrolysis, Waste-to-Energy, Sanitary landfill, Resource recovery.
Unit-III	**Circular Economy and Emerging Technologies:** Circular economy principles, Zero waste concept, Extended Producer Responsibility (EPR), Plastic and e-waste management, Smart waste management systems, Digital tools for waste monitoring, Sustainable packaging, Carbon footprint reduction
Unit-IV	**Environmental Regulations and Sustainable Practices:** Solid Waste Management Rules, Plastic Waste Management Rules, E-Waste Management Rules, Biomedical Waste Management Rules, Green campus initiatives, Waste audit, Case studies on successful waste management, Role of engineers in sustainable waste management, Future trends.

Suggested Readings:

1. George Tchobanoglous, Hilary Theisen and Samuel A. Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw-Hill.
2. P. A. Vesilind, W. A. Worrell and D. R. Reinhart, Solid Waste Engineering, Cengage Learning.
3. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw-Hill.
4. M. N. Rao and H. V. N. Rao, Air Pollution, Tata McGraw-Hill. *(Selected chapters on solid waste and environmental pollution.)*
5. P. Venugopala Rao, Principles of Environmental Engineering, Prentice Hall of India.
6. Central Public Health and Environmental Engineering Organisation (CPHEEO), Manual on Municipal Solid Waste Management, Ministry of Housing and Urban Affairs, Government of India.
7. Central Pollution Control Board (CPCB), Guidelines on Solid Waste, Plastic Waste and E-Waste Management.
8. Ministry of Environment, Forest and Climate Change (MoEFCC), Solid Waste Management Rules, 2016, Plastic Waste Management Rules, 2016, E-Waste Management Rules, 2022, and subsequent amendments.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Fundamentals of Waste Management	Municipal Solid Waste Management (NPTEL - IIT Guwahati)
	Introduction	NPTEL Course Portal – Municipal Solid Waste Management
UNIT-II	Waste Processing & Treatment	Integrated Waste Management for a Smart City (NPTEL - IIT Kharagpur)
	Processing Technologies	Municipal Solid Waste Management (NPTEL Archive)
UNIT-III	Circular Economy & Sustainable Waste Management	Integrated Waste Management for a Smart City (NPTEL - IIT Kharagpur)
UNIT-IV	Environmental Regulations & Case Studies	Municipal Solid Waste Management (NPTEL - IIT Guwahati)

Annexure AC/5.20

~~Annexure 4.5~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)
An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme and Syllabus

Common for B.Tech (Civil Engineering)

And

B.Tech (Civil Engineering – Working Professionals)

Second Year (B-Scheme)

(Under NEP-2020)

(Effective from the session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

Common for B.Tech (Civil Engineering) – 3rd Semester

and

B.Tech (Civil Engineering - Working Professionals) – 3rd Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-CE-201B	Building Construction and Material	3	0	0	3	3	30	45		75	3
2	Professional Core Courses	PCC-CE-203B	Construction Techniques and Equipments	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	PCC-CE-205B	Fluid Mechanics	3	0	0	3	3	30	45		75	3
4	Professional Core Courses	PCC-CE-207B	Surveying	3	0	0	3	3	30	45		75	3
5	Professional Core Courses	PCC-CE-209B	Engineering Geology	3	0	0	3	3	30	45		75	3
6	Engineering Science Courses	ESC-CE-211B	Engineering Mechanics	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-PCC-CE-213B	Building Materials Lab	0	0	2	2	1	10		15	25	3
8	Professional Core Courses	LC-PCC -CE-215B	Fluid Mechanics Lab	0	0	2	2	1	10		15	25	3
9	Engineering Science Courses	LC-ESC -CE-217B	Engineering Mechanics Lab	0	0	2	2	1	10		15	25	3
10	Professional Core Courses	LC-PCC -CE-219B	Surveying Lab	0	0	2	2	1	10		15	25	3
11	Professional Core Course	LC-PCC - CE-221B	CAD Lab	0	0	2	2	1	10		15	25	3
12	Mandatory Courses	MC-201B*	Environmental Science*	2	0	0	2	0	20	30		50*	3
Total Credits								**23**				**575**	

Notes:

I. MC-201B is a mandatory non–credit course in which students will be required to obtain passing marks in theory. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in detailed marks certificate of student.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

Common for B.Tech (Civil Engineering) – 4th Semester

and

B.Tech (Civil Engineering - Working Professionals) – 4th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Basic Science Courses	BSC-CE-202B	Engineering Mathematics-III	3	1	0	4	4	40	60		100	3
2	Professional Core Course	PCC-CE-204B	Hydraulic Engineering	3	0	0	3	3	30	45		75	3
3	Professional Core Course	PCC-CE-206B	Structural Analysis	3	0	0	3	3	30	45		75	3
4	Professional Core Course	PCC-CE-208B	Advanced Surveying	3	0	0	3	3	30	45		75	3
5	Professional Core Course	PCC-CE-210B	Design of Concrete Structures	3	0	0	3	3	30	45		75	3
6	Professional Elective Course	Refer Table-1	Professional Elective-I	3	0	0	3	3	30	45		75	3
7	Professional Core Course	LC-PCC -CE-212B	Hydraulic Engineering Lab	0	0	2	2	1	10		15	25	3
8	Professional Core Course	LC-PCC -CE-214B	Structural Analysis Lab	0	0	2	2	1	10		15	25	3
9	Professional Core Course	LC-PCC -CE-216B	Advanced Surveying Lab	0	0	2	2	1	10		15	25	3
10	Professional Core Course	LC-PCC -CE-218B	Concrete Lab	0	0	2	2	1	10		15	25	3
Total Credits								**23**				**575**	

Notes:

I. At the end of the 4th Semester, each student shall undergo 4–6 weeks of Industrial/Practical Training in a Civil Engineering organization and submit a training report along with a training certificate from the organization. The evaluation shall be carried out in the 5th Semester.

II. For Working Professionals: Submit a Training/Project report of their work in their respective company/Organization for the period of summer training/industrial training for evaluation. The evaluation shall be carried out in the 5th Semester.

III. Students must choose one course from the Professional Elective–I category (Table 1). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table 1 Professional Elective – I

Sr. No.	Code	Subject
1	PEC-CE-220B	Repair and Rehabilitation of Structures
2	PEC-CE-222B	Climate Hazards and Disaster Mitigation
3	PEC-CE-224B	Material Testing and Evaluation
5	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Course Code	**PCC-CE-201B**				
Category	**Professional Core Course**				
Course Title	**Building Construction and Material**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide knowledge of building components and construction techniques. • To understand properties and applications of construction materials. • To develop ability to select suitable materials for various construction requirements. • To familiarize students with construction practices and standards.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define building materials, components, and construction terminology.	Level 1: Remember
CO2	Understand construction practices and functional requirements of buildings.	Level 2: Understand
CO3	Apply suitable materials and construction techniques.	Level 3: Apply
CO4	Analyze building components for durability and sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Building Planning and Masonry:** Building planning principles, Functional components of buildings, Building terminology, Building orientation, Modular coordination, Masonry units, Mortars and mortar joints, Brick masonry bonds, Masonry construction practices, Composite masonry, Glass block masonry, Quality of workmanship, Common defects in masonry. **Module 2: Roofs, Floors and Openings:** Roof systems, Roof coverings, King-post and Queen-post trusses, Floor systems, Floor finishes, Doors, Windows, Ventilators, Aluminium and uPVC door-window systems, Hardware, Fixtures and fastener.
Unit-II	**Module 3: Timber and Building Products:** Timber properties and preservation, Engineered wood products, Plywood, Blockboard, Particle board, Fibre boards, Architectural glass, Glazing systems, Composite panels, Lightweight building products. **Module 4: Building Finishes and Surface Materials:** Building stones, Stone finishes, Stone cladding, Flooring systems, Ceramic, Vitrified and Cement concrete tiles, Wall finishes, Paints, Primers, Varnishes, Protective coatings, Decorative finishes, Building envelope materials.

Unit-III	**Module 5: Walls and Foundations:** Load-bearing and framed construction, Load-bearing and non-load-bearing walls, Cavity walls, Partition walls, Selection of foundation systems, Shallow foundations, Masonry foundations, Basic site investigation, Foundations in difficult soil conditions, Introduction to deep foundations. **Module 6: Staircases and Accessibility:** Planning and layout of staircases, Stair terminology, Types of staircases, Accessibility provisions, Universal design principles, Ramps, Lifts, Escalators, Moving walkways.
Unit-IV	**Module 7: Building Protection:** Damp-proofing, Waterproofing, Fire-resistant construction, Fire-resistant materials, Thermal insulation, Acoustic insulation, Moisture control, Weather protection, Building durability concepts. **Module 8: Emerging Building Materials:** AAC blocks, Geosynthetics, Fibre Reinforced Polymer (FRP) products, Fibre cement boards, Composite building panels, Lightweight building materials, Recycled building materials, Smart building materials, Energy-efficient building materials, Sustainable building products..

Suggested Readings:

1. Building Construction by Sushil Kumar, Standard Pub., N. Delhi
2. Building Material by Rangawala
3. Construction Engineering by Y.S. Sane
4. Building Construction by Gurcharan Singh, Standard Pub., N. Delhi

Useful Video Links

Unit No.	Topic	Link
Unit-I	**Building Planning & Components**	https://www.youtube.com/results?search_query=nptel+building+planning+civil+engineering
	Building Stones	https://www.youtube.com/results?search_query=building+stones+civil+engineering
Unit-II	**Timber in Construction**	https://www.youtube.com/results?search_query=timber+building+materials+nptel
	Roofing Systems	https://www.youtube.com/results?search_query=roofing+systems+building+construction
Unit-III	**Wall Construction**	https://www.youtube.com/results?search_query=load+bearing+wall+construction
	Staircase Planning	https://www.youtube.com/results?search_query=staircase+planning+civil+engineering
Unit-IV	**Waterproofing**	https://www.youtube.com/results?search_query=waterproofing+building+construction
	Smart & Sustainable Materials	https://www.youtube.com/results?search_query=smart+building+materials+civil+engineering

Course Code	**PCC-CE-203B**				
Category	**Professional Core course**				
Course Title	**Construction Techniques and Equipments**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To understand the fundamentals of construction equipment and techniques. • To familiarize with modern construction methods and site practices. • To develop knowledge of construction planning, safety, and quality in civil engineering projects.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamentals of construction equipment and techniques.	Level 1: Remember
CO2	Explain construction methods and techniques.	Level 2: Understand
CO3	Apply construction principles to civil engineering works.	Level 3: Apply
CO4	Analyze construction practices for efficient project execution.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Earthmoving and Material Handling Equipment:** Classification and selection of construction equipment, Earthmoving equipment (Excavators, Bulldozers, Loaders, Scrapers), Hauling and compacting equipment, Material handling equipment (Cranes, Hoists, Conveyors, Equipment productivity and safety. **Module 2: Concrete Construction Equipment:** Concrete batching and mixing plants, Transit mixers, Concrete pumps, Vibrators, Concrete placing and finishing equipment, Asphalt plants and road paving equipment, Equipment maintenance.
Unit-II	**Module 3: Temporary Works and Site Preparation:** Site clearance and site preparation, Excavation and dewatering methods, Temporary works in construction, Basic concepts of formwork, Centering, Falsework, Scaffolding, Shoring and bracing, Construction joints, Inspection and safety during temporary works. **Module 4: Industrialized Construction Systems:** Prefabrication, Precast concrete construction, Modular construction, Pre-engineered buildings (PEB), Segmental construction, Composite construction, Slip form construction, Tunnel form construction, Jump form construction, Advantages and limitations.
Unit-III	**Module 5: Specialized Construction Techniques:** Bridge construction methods, Deep excavation, Cofferdams, Sheet piling, Underwater concreting, Trenchless construction (Pipe jacking and Micro-tunnelling), Construction in difficult ground conditions.

	Module 6: Construction Planning and Site Management: Construction sequence and workflow, Site layout and organization, Material storage and handling, Temporary facilities, Resource utilization, Productivity improvement techniques, Introduction to Lean Construction, Construction records and documentation.
Unit-IV	**Module 7: Heavy Construction and Infrastructure Development:** Construction of highways, Railways, Bridges, Tunnels, Dams, Airports, Multistoreyed buildings, Steel structures, Precast construction, Challenges in large infrastructure projects. **Module 8: Construction Safety and Quality Management:** Construction safety management, PPE, Hazard identification, Risk assessment, Inspection procedures, Construction quality assurance, Construction documentation, Construction waste management, Sustainable construction practices.

Suggested Readings

1. R.L. Peurifoy, C.J. Schexnayder & A. Shapira – Construction Planning, Equipment and Methods (McGraw Hill)
2. S.C. Sharma & S.K. Duggal – Building Construction (McGraw Hill India)
3. B.C. Punmia, A.K. Jain & A.K. Jain – Building Construction (Laxmi Publications)
4. S.C. Rangwala – Building Construction (Charotar Publishing House)
5. Dr. Mahesh Varma – Construction Equipment and Methods (Metropolitan)
6. G.R. Raina & S.K. Gupta – Construction Management and Equipment
7. M.L. Gambhir – Building and Construction Materials (McGraw Hill Education)
8. NPTEL – Construction Planning and Equipment – https://nptel.ac.in
9. CPWD Works Manual – https://cpwd.gov.in

Useful Video Links

Unit No.	Topic	Link
Unit -I	Construction Equipment (Earthmoving & Material Handling)	https://www.youtube.com/playlist?list=PLbMVogVj5nJQ5kq5z6zq1Q8o8qk0qkqkq
	Concrete Construction Equipment	https://civilblog.org/building-materials-and-construction-civil-engineering-video-lectures/
Unit -II	Formwork Systems	https://civilblog.org/building-materials-and-construction-civil-engineering-video-lectures/
	Industrialized Construction	https://www.youtube.com/user/NPTELHRD/playlists
Unit -III	Bridge & Tunnel Construction	https://www.youtube.com/watch?v=0olpSN6_TCc
	Deep Excavation & Cofferdams	https://www.youtube.com/watch?v=HowDoSpillwaysWork-fjapgTd-QUg
Unit -IV	Construction Safety Practices	https://www.youtube.com/watch?v=j04CtMzo_0Y
	Conceptual Engineering Insights	https://www.youtube.com/@PracticalEngineeringChannel

Course Code	**PCC-CE-205B**				
Category	**Professional Core Course**				
Course Title	**Fluid Mechanics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce properties and behavior of fluids at rest and in motion. • To develop understanding of fluid statics and fluid dynamics principles. • To enable analysis of pipe flow and open channel flow problems. • To prepare students for hydraulic engineering applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define basic concepts of fluids.	Level 1: Remember
CO2	Understand properties of fluids.	Level 2: Understand
CO3	Apply equations of fluid flow to solve engineering problems.	Level 3: Apply
CO4	Analyze the behavior of fluid flow.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module1: Fluids and Their Properties:** Introduction of fluid, fluid classifications, hypothesis of continuum, Shear stress in a moving fluid, molecular structure of material, fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitations, compressibility and the bulk modulus. **Module2 : Pressures and Head:** Types of Pressure, Pascal's law of pressure at a point, variation of pressure vertically in a fluid under gravity, equality of pressure at the same level in a static fluid, general equation for the variation of pressure due to gravity from a point to point in a static fluid, pressure and head, the hydrostatic paradox**.**
Unit-II	**Module 3 : Static Forces on Surface and Buoyancy:** Fluid static, action of fluid pressure on surface, resultant force and centre of pressure on a plane surface under uniform pressure, resultant force and centre of pressure on a plane surface immersed in a liquid, pressure diagrams, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacentre relative to the centre of buoyancy. **Module 4: Motion of Fluid Particles and Streams:** Fluid flow, different types of flow, frames of reference, analyzing fluid flow, motion of a fluid particle, acceleration of a fluid particle, discharge and mean velocity, continuity of flow, continuity equations for 2-D and 3-D flow in Cartesian coordinates of system.

Unit-III	**Module 5: The Energy Equation and its Application:** Momentum and fluid flow, Momentum equation for 2-D and 3-D flow along a stream line, momentum correction factor, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid – Bernoulli's theorem, kinetic energy correction factor, pitot tube, determination of volumetric flow rate via pitot tube, changes of pressure in tapering pipe, principle of venturimeter, pipe orifices, theory of small orifices discharging to atmosphere, theory of large orifices, Rotameter, elementary theory of notches and weirs, flow in a curved path. **Module 6: Dimensional Analysis And Similarities:** Dimension reasoning, dimensional homogeneity, dimensional analysis using Rayleigh's method, Buckingham π-theorem, significance of dimensionless, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity, Kinematic similarity, model testing-Model laws, Undistorted and Distorted models
Unit-IV	**Module 7: Flow Through Pipes:** Boundary layer flow, Elementary turbulent flow, Flow through pipes, Head losses in pipes, Bends and Fittings, Reynold's experiments, Prandtl mixing length hypothesis, Velocity distribution in pipes, Concept of smooth and rough pipes, Pipe friction factor relations. Pipe network.

Suggested Readings:

1. Hydraulic and Fluid Mechanic by P.N.Modi&S.M.Seth
2. Introduction to Fluid Mechanics by Robert W.Fox& Alan T.McDonald 3 Fluid Mechanics Through Problems by R.J.Garde
3. Engineering Fluid Mechanics by R.J.Garde&A.G.Mirajgaoker
4. Fluid Mechanic and Hydraulic machines R.K. BANSAL

Useful Video Links

Unit No.	Topic	Link
Unit-I	Fluids and Their Properties	https://youtu.be/iTanaNwMDKo?si=_6zrC4tftGCfjcIw
	Pressures and Head	https://youtu.be/38xWEHdUjD0?si=0rkPRLcfpMPECk8a
Unit-II	Static Forces on Surface and Buoyancy	https://youtu.be/9bdGZkkHukA?si=cOuXF9YrsNt_VEXt
	Motion of Fluid Particles and Streams	https://youtu.be/jnDbVE17Pzg?si=5Y4PVBzFDOYTFJto
Unit-III	The Energy Equation and its Application	https://youtu.be/WGuzqF2GCBg?si=AmyZNyaVxkG8SRIJ
	Dimensional Analysis And Similarities	https://youtu.be/tV3ShM1fo5Y?si=YqqMpjXoEEzb7gtH
Unit-IV	Flow Through Pipes	https://youtu.be/1X71UfOCEU4?si=GMIX_i71UAfC0QmS

Course Code	**PCC-CE-207B**				
Category	**Professional Core Course**				
Course Title	**Surveying**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are: •To impart knowledge of fundamental surveying principles and measurement techniques used in civil engineering practice. •To develop competency in the use of chain, compass, level, theodolite, and related surveying instruments. •To enable computation and adjustment of levelling, traversing, and contouring data.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of surveying.	Level 1: Remember
CO2	Understand methods of surveying.	Level 2: Understand
CO3	Apply surveying techniques for measurement of civil engineering projects.	Level 3: Apply
CO4	Analyze survey data and errors.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Surveying Fundamentals and Direction Measurement:** Definition and objectives of surveying, principles and classification of surveying, instruments for linear measurement, methods of linear measurement – chaining and taping, errors in linear measurement and tape corrections , types of compass – prismatic and surveyor's compass, bearings – whole circle and reduced bearing, meridians – true, magnetic and arbitrary, magnetic declination, local attraction – causes, detection and correction, methods of compass traversing, checks in traversing, adjustment of closed traverse with examples. **Module 2: Leveling and Geodetic Trigonometric leveling:** Terms used in leveling, types of levels and staff, principles of levelling, reduction of levels and booking of staff readings, examples. Height and distances- base of the object accessible and inaccessible, geodetically observation, correction due to curvature and refraction, axis signal correction, difference in elevation between two points.
Unit-II	**Module 3: Plane Table Surveying:** Plane table accessories, Types and methods of plane table surveying, sources of error, advantages and disadvantages of plane table surveying. **Module 4: Contouring:** Contours and characteristics of contour lines, Contour interval and Factor affecting CI locating contours, interpolation of contours, Use of contour maps.

Unit-III	**Module 5: Angle Measurement:** Theodolite, parts of theodolite, Temporary adjustment of Theodolite, measurement of horizontal and vertical angles by different methods, theodolite traversing, adjustments of closed traverse. **Module 6: Tachometric surveying:** Principle of tacheometric surveying, different instrument used in tacheometry, stadia and tangential method of tacheometry, tacheometric constants and their determinations, examples.
Unit-IV	**Module 7: Curves:** Classification of curves, elements of simple circular curve, location of tangent points- chain and tape methods, instrumental methods, Examples; types of transition curves; Vertical Curves: Necessity and types of vertical curves, setting out of a vertical curve. **Module 8: Total Station – Basic Concepts**: Definition and purpose of Total Station, main components – electronic theodolite, EDM and other method of distance measurement.

Suggested Readings:

- Surveying volume I and II: B C Punmia.
- Engineering Surveying (Sixth Edition): W. Schofield.
- Text Book of Surveying: C. Venkataramiah.
- Introduction to GPS: The Global Positioning System: Ahmed El-Rabbany.
- Surveying by Duggal.
- Various Online resources including NPTEL.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Basics of Surveying and Linear measurement	https://youtu.be/chhuq_t40rY?si=O-rZ0GyeQRQ0I1Ht
	Terms used in levelling	https://youtu.be/La5A5PLQjaQ?si=e6zg_3GViavxOn
Unit-II	Methods of plane table surveying	https://youtu.be/COldgKBaiqw?si=8ONvMgLWwjP8Ql2p
	Contours and characteristics of contour lines	https://youtu.be/pHarJN7Wo0M?si=WzMPfR8rcJid_GoQ
Unit-III	Theodolite, parts of theodolite	https://youtu.be/6yyMZSHCbCo?si=qX3gYxRgeXr6Ef4s
	Tachometric surveying	https://www.youtube.com/watch?v=HuJMSS3T070&list=PL5UuHQx1lpk3VBalpNcdAgxXSwG9QGyZp
Unit-IV	Curves, Classification of curves	https://youtu.be/EMFPb3Rn7Jw?si=mEJPVQhLMuYcf39L
	Total Station – Basic Concepts	https://youtu.be/a2Z1Z_M6SEo?si=IxvBgExEABmO5Xgg

Course Code	PEC-CE-209B				
Category	Professional Core Course				
Course Title	Engineering Geology				
Scheme and Credits	L	T	P	Credits	Semester-III
	3	0	0	3	
Course Objectives	The objectives of this course are: • To provide fundamental knowledge of geology, minerals, rocks, and geological processes relevant to civil engineering. • To develop skills for map interpretation, rock analysis, and evaluation of geological conditions in engineering projects and hazards.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	70 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of geology, minerals, rocks, and earth structure.	Level 1: Remember
CO2	Understand geological processes like weathering, erosion, petrology, and structural geology.	Level 2: Understand
CO3	Apply geological knowledge to map interpretation, identification of minerals/rocks, and engineering evaluation of rock properties.	Level 3: Apply
CO4	Analyze geological conditions in civil engineering projects (dams, slopes, earthquakes) and assess hazards with suitable measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1 : Introduction**: Scope, Subdivision of Geology, Interior of Earth, Importance of Geological Studies in Various Civil Engineering Projects, Department Dealing with this Subject in India and their Scope of Work- GSI, Granite Dimension Stone Cell, NIRM; Use of Geological Maps and Interpretation of Data. **Module 2: Physical Geology**: External and Internal Geological Forces Causing Changes; Weathering, Erosion and Denudation of the Surface of the Earth; Factors Affecting Weathering and Product of Weathering; Superficial Deposits and its Geotechnical Importance: Water Fall and Gorges, River Meandering, Alluvium, Glacial Deposits, Desert Landform, Loess, Mudflows, Coastal Deposits.
Unit-II	**Module 3 : Mineralogy** : Origin and Composition of Minerals, Physical Properties of Minerals, Susceptibility of Minerals to Alteration, Rock Forming Minerals, Megascopic Identification of Common Primary and Secondary Minerals. **Module 4 : Petrology**: Rock Formation Processes, Ternary Diagram, Igneous Petrology- Volcanic Phenomenon, Types of Volcanic Eruption, Chemical and Mineralogical Composition, Texture and its Types, Sedimentary Petrology- Mode of Formation, Mineralogical Composition, Texture and its Types; Metamorphic Petrology- Agents and Types of Metamorphism, Metamorphic Grades, Mineralogical Composition, Structures and Textures.

Unit-III	**Module 5: Structural Geology**: Forms and Structures of Rocks, Stress and Strain in Rocks, Deformation and Tectonics, Dip and Strike, Bedding Planes and Outcrops; Fold- Types and Nomenclature, Criteria for Their Recognition in Field; Faults: Classification, Recognition in Field. **Module 6 : Properties of Rock Masses**: Sub Surface Investigations of Rocks and Engineering Characteristics of Rocks Masses; Field and Laboratory Tests on Rocks, Stress Deformation and Bearing Capacity of Rocks, Important Variables Influencing Rock Properties and Behaviour, Measurement of Velocity of Sound in Rock.
Unit-IV	**Module 7 : Geology of Dam and Reservoir**: Site Geological Consideration for Selecting Dam and Reservoir Site, Causes of Failure of Reservoir, Favourable and Unfavourable Conditions in Different Types of Rocks in Presence of Various Structural Features, Precautions to Counteract Unsuitable Conditions. **Module 8: Geological Hazards:** Rock Instability and Slope Movement; Concept of Sliding, Consequences of Land Sliding, Prevention by Surface Drainage, Slope Reinforcement by Rock Bolting and Rock Anchoring; Earthquake: Magnitude and Intensity of Earthquake, Seismic Waves; Seismic Zones in India.

Suggested Readings

- A textbook of Geology by P.K Mukherjee
- Physical and General Geology by SK Garg
- Engineering and General Geology by Prabin Singh.
- Introduction of physical Geology by A.holmes

Useful Video Links

Unit No.	Topic	Link
Unit-I	Scope, Subdivision of Geology	https://youtu.be/ksJpBG0R5pM?si=5cOmhlDq6Xb0awyf
	Weathering, Erosion and Denudation of the Surface of the Earth	https://youtu.be/GCiSOGweitU?si=ic3lArR5MbmJW8k3
Unit-II	Origin and Composition of Minerals	https://youtu.be/kVopWFgOcrU?si=f3pJdh4aNfhq2-DZ
	Sedimentary Petrology	https://www.youtube.com/live/ezqUycfNlzE?si=obAP9KAHLaAkI1Rz
Unit-III	Dip and Strike, Bedding Planes and Outcrops	https://youtu.be/WdBtwf3vl_0?si=y3aNj_0tu0CX2MBD
	Sub Surface Investigations of Rocks	https://youtu.be/ZLmqtF2FtkU?si=fs6mlkfDoktkC3cO
Unit-IV	Dam and Reservoir Site	https://youtu.be/bDwow2-WzHo?si=drnCdQXbKE1C8YEU
	Earthquake: Magnitude and Intensity of Earthquake	https://youtu.be/mWXpUo-_KOw?si=LPPrSZANDX9MDRCx

Course code	**ESC-CE-211B**				
Category	**Engineering Science Course**				
Course title	**Engineering Mechanics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce fundamental principles of statics and mechanics of rigid bodies. • To develop ability to analyze forces, moments, and equilibrium conditions. • To apply mechanics principles to solve engineering problems. • To build foundation for advanced structural subjects.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define basic concepts of engineering mechanics.	Level 1: Remember
CO2	Understand behavior of various force systems.	Level 2: Understand
CO3	Apply mechanics principles to solve structural problems.	Level 3: Apply
CO4	Analyze structural components under various loading conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Force Systems and Friction:** System of forces, equilibrium of particles and rigid bodies in two and three dimensions, Free Body Diagrams (FBDs), support reactions, internal forces in structural members (axial force, shear force and bending moment), dry friction, laws of friction, angle of friction, angle of repose, applications of friction (ladders, wedges and belt). **Module 2: Simple and Compound Stresses and Strains:** Mechanical properties of engineering materials, normal and shear stresses and strains, Hooke's law, elastic constants and their relationships, Poisson's ratio, stresses and deformation of prismatic, stepped and tapered bars under axial loading and self-weight, compound bars, thermal stresses and strains, factor of safety, proof stress.
Unit-II	**Module 3: State of Stress and Strain:** Stress transformation under plane stress, principal stresses and principal planes, principal strains, maximum shear stress, Mohr's Circle for stress analysis, combined normal and shear stresses. **Module 4: Shear Force and Bending Moment:** Classification of beams and loading systems, shear force and bending moment, differential relationships among load, shear force and bending moment, axial force, shear force and bending moment diagrams for statically determinate beams, point of contra-flexure.

Unit-III	**Module 5: Flexural and Torsional Behaviour:** Theory of simple bending, flexure formula, bending stresses, combined direct and bending stresses, section modulus, composite beams, kern and middle-third rule, transverse shear stress distribution in beams, theory of pure torsion, torsion equation, solid and hollow circular shafts, power transmission through shafts, shafts in series and parallel, combined bending and torsion. **Module 6: Thin Pressure Vessels and Columns:** Thin cylindrical pressure vessels, circumferential (hoop) stress, longitudinal stress, volumetric strain, classification of columns, slenderness ratio, Euler's buckling theory, Rankine-Gordon formula, eccentrically loaded columns.
Unit-IV	**Module 7: Analysis of Plane Trusses:** Classification of trusses, perfect, deficient and redundant trusses, zero-force members, analysis of statically determinate plane trusses by Method of Joints and Method of Sections. **Module 8: Failure Theories:** Maximum Principal Stress Theory, Maximum Principal Strain Theory, Maximum Shear Stress Theory (Tresca Criterion), Maximum Strain Energy Theory, Distortion Energy Theory (von Mises Criterion), comparison and applications of failure theories.

Suggested Readings

- Strength of Material by G.H. Ryder, MacMillan Publishers India Ltd.
- Mechanics of Materials by E.J. Hearn, Elsevier Publications.
- Mechanics of Materials by Punmia and Jain, Laxmi Publications (P) Ltd.
- Mechanics of Materials by R.C. Hibbeler, Pearson Higher Education.
- Strength of Materials by Timoshenko and Young,, East West Press.
- Mechanics of materials by V Gupta, Narosa publishing house.

Useful Video Links

Unit No.	Topic	Link
I	Simple Stresses and Strains	https://youtu.be/DzyIEz3dKXQ?si=_k7krOEATzbR uU1Z
II	Compound stress and strains	https://youtu.be/EDdUiNHLF2o?si=- qcKtD_1pof_AEA4
III	Buckling of columns	https://youtu.be/vhXJ6ZcKb5c?si=jHZ2-2e595JXXwSC
IV	Different types of trusses	https://youtu.be/ef- 5HtnBubU?si=pqpXD05mgSuGrabd

Course code	**LC-PCC-CE-213B**				
Category	**Lab Course**				
Course title	**Building Materials Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives:	The objectives of this course are: • Understand the basic properties of construction materials. • Develop practical skills in testing and handling construction materials. • Interpret laboratory test results using standard procedures. • Assess the quality and suitability of materials for construction applications.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Identify the properties of common construction materials.	Level 1: Remember
CO2	Explain standard testing procedures and relevant specifications for construction materials.	Level 2: Understand
CO3	Demonstrate laboratory tests on construction materials following standard procedures.	Level 3: Apply
CO4	Analyze test results to assess the construction materials for engineering applications.	Level 4: Analyze

List of Experiments

1. Determination of normal consistency of cement.
2. Determination of initial and final setting time of cement.
3. Determination of fineness of cement.
4. Determination of soundness of cement.
5. Determination of compressive strength of cement mortar.
6. Sieve analysis of fine and coarse aggregates.
7. Determination of specific gravity and water absorption of aggregates.
8. Determination of bulk density and void ratio of aggregates.
9. Testing of bricks for dimensions, water absorption, efflorescence and compressive strength.
10. Testing of concrete blocks and AAC blocks.
11. Determination of moisture content and basic properties of timber.
12. Identification and study of building products such as plywood, fibre boards, aluminium, uPVC and architectural glass.

Useful Video links:

Exp. No.	Topics	Links
1	Determination of Normal Consistency of Cement	https://www.youtube.com/results?search_query=normal+consistency+of+cement+vicat+apparatus
2	Determination of Initial and Final Setting Time of Cement	https://www.youtube.com/results?search_query=initial+and+final+setting+time+of+cement+vicat+apparatus
3	Determination of Fineness of Cement	https://www.youtube.com/results?search_query=fineness+test+of+cement+sieve+test
4	Determination of Soundness of Cement	https://www.youtube.com/results?search_query=soundness+test+of+cement+le+chatelier+apparatus
5	Determination of Compressive Strength of Cement Mortar	https://www.youtube.com/results?search_query=compressive+strength+test+of+cement+mortar
6	Sieve Analysis of Fine and Coarse Aggregates	https://www.youtube.com/results?search_query=sieve+analysis+of+fine+and+coarse+aggregates
7	Specific Gravity and Water Absorption of Aggregates	https://www.youtube.com/results?search_query=specific+gravity+and+water+absorption+test+of+aggregates
8	Bulk Density and Void Ratio of Aggregates	https://www.youtube.com/results?search_query=bulk+density+and+void+ratio+of+aggregates
9	Testing of Bricks (Dimensions, Water Absorption, Efflorescence & Compressive Strength)	https://www.youtube.com/results?search_query=brick+testing+water+absorption+efflorescence+compressive+strength
10	Testing of Concrete Blocks and AAC Blocks	https://www.youtube.com/results?search_query=concrete+block+and+AAC+block+testing
11	Moisture Content and Basic Properties of Timber	https://www.youtube.com/results?search_query=timber+moisture+content+test+and+properties
12	Identification of Building Products (Plywood, Fibre Boards, Aluminium, uPVC & Glass)	https://www.youtube.com/results?search_query=building+materials+plywood+fibre+board+aluminium+uPVC+glass

Course code	**LC-PCC-CE-215B**				
Category	**Lab Course**				
Course title	**Fluid Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives:	The objectives of this course are: • To conduct experiments related to fluid flow and measurement. • To verify theoretical principles through experimentation. • To analyze experimental data and hydraulic performance.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall hydraulic instruments, measuring devices, and fluid properties.	Level 1: Remember
CO2	Understand principles of fluid flow, pressure, and discharge measurement.	Level 2: Understand
CO3	Illustrate experiments to determine flow characteristics.	Level 3: Apply
CO4	Analyze flow characteristics and energy losses.	Level 4: Analyze

List of Experiments

1. Verification of Bernoulli's Theorem
2. Calibration of V notch
3. Calibration of Rectangular notch
4. Calibration of Trapezoidal notch
5. Study of Pressure Measuring Devices
6. Determination of Metacentric height
7. Hydrostatics Force on Flat Surfaces/Curved Surfaces
8. Venturimeter
9. Orifice meter
10. Determination of coefficient Cd, Cv, and Cc

Useful Video links:

Exp. No	Experiment	Links
1	Verification of Bernoulli's Theorem	https://www.youtube.com/watch?v=m90wPNvxAIg
2	Calibration of V notch	https://www.youtube.com/watch?v=ILY4QMQIY5s
3	Calibration of Rectangular notch	https://www.youtube.com/watch?v=0u-jamQjVk0
4	Calibration of Trapezoidal notch	https://www.youtube.com/watch?v=ZOVlvLVYDjE

Course code	**LC-ESC-CE-217B**				
Category	**Lab Course**				
Course title	**Engineering Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives:	The objectives of this course are: • To provide practical exposure to mechanics principles through experiments. • To develop skills in conducting experiments and interpreting results. • To correlate theoretical concepts with experimental observations.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of engineering mechanics.	Level 1: Remember
CO2	Understand the principles of equilibrium, friction, and mechanical behavior of bodies.	Level 2: Understand
CO3	Illustrate experiments related to forces, moments, friction, and centroids.	Level 3: Apply
CO4	Analyze experimental results and compare them with theoretical values.	Level 4: Analyze

List of Experiments

1. To determine elastic properties of a beam.
2. Torsion of cylindrical rods (Shaft).
3. To determine and analyse deflection of curved beams.
4. Experimental and analytical study of behaviour of struts with various end conditions.
5. To determine deflection of trusses – Horizontal and vertical deflection of various joints of a pin jointed truss.
6. Experimental and analytical study of a 3bar pin jointed Truss.
7. Experimental and analytical study of an elastically coupled beam.
8. To plot stress- strain curve for mild steel – Demonstration

Useful Video links:

Exp. No	Experiment	Links
1	To determine elastic properties of a beam.	https://www.youtube.com/watch?v=nC0Sk36SZ0w
2	To determine and analyze deflection of curved beams.	https://www.youtube.com/watch?v=cGTebUY2xQc
3	Experimental and analytical study of behavior of struts with various end conditions.	https://www.youtube.com/watch?v=wgCXC-8UOU0
4	Experimental and analytical study of a 3bar pin jointed Truss.	https://www.youtube.com/watch?v=Lwzcwm3oL8A

Course code	**LC-PCC-CE-219B**				
Category	**Lab Course**				
Course title	**Surveying Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives:	The objectives of this course are: • To develop practical skills in the use of surveying instruments such as chain, compass, level, theodolite, and total station. • To train students in conducting field surveys for measurement of distances, angles, elevations, and contours. • To develop competency in preparation of field books, survey maps, plans, and contour drawing.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall surveying instruments, symbols, and field terminology.	Level 1: Remember
CO2	Understand principles of surveying.	Level 2: Understand
CO3	Perform field surveys using conventional surveying instruments.	Level 3: Apply
CO4	Analyze survey data to outline field observations.	Level 4: Analyze

List of Experiments

1. Chain Traversing and Compass Traversing
2. Differential Levelling
3. Fly Levelling
4. Cross Sectioning
5. Profile levelling
6. Plane Table surveying: Radiation and Intersection
7. Resection- 2 and 3-point problem with plane Table
8. Contouring and preparation contour map.
9. Demonstration of total station.

Useful Video links:

Exp. No	Experiment	Links
1	Chain Traversing	https://www.youtube.com/watch?v=hpbt71TljEA
2	Compass Traversing	https://www.youtube.com/watch?v=TKzEBJ1qkz8
3	Fly Levelling	https://www.youtube.com/watch?v=KDG9IJBP_bE
4	Cross Sectioning	https://www.youtube.com/watch?v=irNlaNP63nA

Course Code	**LC-PCC-CE-221B**				
Category	**Lab Course**				
Course Title	**Civil Engineering CAD Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To introduce basic computer-aided drafting concepts for civil engineering applications. • To develop skills in 2D drafting and building drawing using CAD software. • To understand building planning principles and apply them in design drawings. • To prepare complete residential building drawings including plan, elevation, and section.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall CAD tools and drafting commands used in building drawing.	Level 1: Remember
CO2	Explain building planning principles and CAD drafting concepts.	Level 2: Understand
CO3	Apply CAD skills to prepare building plans, elevations, and sections.	Level 3: Apply
CO4	Analyze and develop complete residential building drawings using CAD software.	Level 4: Analyze

List of Experiments

1. Study of CAD software interface and basic drawing setup.
2. Practice of basic drawing commands (Line, Circle, Arc, Rectangle).
3. Application of modify commands (Move, Copy, Rotate, Mirror, Scale).
4. Use of Trim, Extend, Offset, Fillet, and Chamfer commands.
5. Creation and management of layers, text, and annotation tools.
6. Preparation of dimensioned geometrical drawings.
7. Drawing of basic civil engineering components such as doors, windows, and walls.
8. Preparation of a simple residential building layout plan.
9. Preparation of a fully dimensioned single-storey residential building plan.
10. Preparation of a two-storey residential building plan with staircase.
11. Drawing of front elevation of a residential building.
12. Preparation of longitudinal and transverse building sections.
13. Development of a site plan including setbacks and orientation.
14. Preparation of complete residential building drawing as a CAD project sheet.
15. Exporting and plotting of CAD drawings in standard formats.

Useful Video Links:

Exp. No.	**Experiment**	**Link**
1	Study of CAD Software Interface and Drawing Setup	https://www.youtube.com/results?search_query=AutoCAD+interface+and+drawing+setup+for+beginners

2	Basic Drawing Commands (Line, Circle, Arc, Rectangle)	https://www.youtube.com/results?search_query=AutoCAD+basic+drawing+commands+tutorial
3	Modify Commands (Move, Copy, Rotate, Mirror, Scale)	https://www.youtube.com/results?search_query=AutoCAD+modify+commands+tutorial
4	Trim, Extend, Offset, Fillet and Chamfer	https://www.youtube.com/results?search_query=AutoCAD+trim+extend+offset+fillet+chamfer
5	Layers, Text and Annotation	https://www.youtube.com/results?search_query=AutoCAD+layers+text+dimension+annotation
6	Dimensioned Geometrical Drawings	https://www.youtube.com/results?search_query=AutoCAD+dimensioning+geometrical+drawing
7	Drawing Doors, Windows and Walls	https://www.youtube.com/results?search_query=AutoCAD+doors+windows+walls+drawing
8	Simple Residential Building Layout Plan	https://www.youtube.com/results?search_query=AutoCAD+simple+house+plan+tutorial
9	Single-Storey Residential Building Plan	https://www.youtube.com/results?search_query=AutoCAD+single+storey+house+plan
10	Two-Storey Residential Building Plan with Staircase	https://www.youtube.com/results?search_query=AutoCAD+two+storey+house+plan+with+staircase
11	Front Elevation of Residential Building	https://www.youtube.com/results?search_query=AutoCAD+house+elevation+tutorial
12	Longitudinal and Transverse Building Sections	https://www.youtube.com/results?search_query=AutoCAD+building+section+drawing
13	Site Plan with Setbacks and Orientation	https://www.youtube.com/results?search_query=AutoCAD+site+plan+drawing+tutorial
14	Complete Residential Building CAD Project	https://www.youtube.com/results?search_query=AutoCAD+complete+house+drawing+project
15	Exporting and Plotting CAD Drawings	https://www.youtube.com/results?search_query=AutoCAD+plot+print+export+PDF+tutorial

Course code	**MC-201B**				
Category	**Mandatory Courses**				
Course title	**Environmental Science**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	2	0	0	**2**	
Course Objectives	The objectives of this course are: • To create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources. • To develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health. • To foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society. • To engage students in practical learning through fieldwork and case studies to apply environmental concepts for sustainable development and responsible citizenship.				
Assessment	20 Marks				
End Semester Examination	30 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe key terminologies of environmental studies, natural resources, ecosystems, pollution, environmental laws and human-environment interactions.	Level 1: Remember
CO2	Explain the relationships among ecosystems, biodiversity, pollution, social issues, environmental ethics and related legislation for sustainable development.	Level 2: Understand
CO3	Apply principles of environmental management, pollution control, disaster management and sustainable practices in real world environmental contexts.	Level 3: Apply
CO4	Analyze environmental issues, population growth impacts, climate change, welfare programs and the role of information technology in promoting public health and environmental sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 04 parts (Covering all units) of 1.5 marks each and remaining eight questions of 06marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**The Multidisciplinary Nature of Environmental Studies:** Definition, Scope and Importance. **Natural Resources:** Renewable and Non-Renewable Resources; Natural Resources and Associated Problems. **(a) Forest Resources:** Use and Over-Exploitation, Deforestation, Case Studies, Timber Extraction, Mining, Dams and their effects on Forests and Tribal People. **(b) Water Resources:** Use and Over-Utilization of Surface and Groundwater, Floods, Drought, Conflicts Over Water, Dams—Benefits and Problems. **(c) Mineral Resources:** Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies.

	(d) Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer and Pesticide Problems, Waterlogging, Salinity, Case Studies. **(e) Energy Resources:** Growing Energy Needs, Renewable and Non-Renewable Energy Sources, Use of Alternate Energy Sources, Case Studies. **(f) Land Resources:** Land as a resource, Land Degradation, Man-Induced Landslides, Soil Erosion and Desertification. Role of an Individual in Conservation of Natural Resources, Equitable Use of Resources for Sustainable Lifestyles.
Unit-II	**Ecosystems:** Producers, Consumers and Decomposers, Energy Flow in the Ecosystem, Ecological Succession, Food Chains, Food Webs and Ecological Pyramids—Introduction, Types, Characteristic Features, Structure and Function of Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem and Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans and Estuaries). **Biodiversity and Its Conservation:** Introduction, Definition, Genetic Diversity, Species Diversity and Ecosystem Diversity. Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation, Hotspots of Biodiversity. **Values of Biodiversity:** Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values. **Threats to Biodiversity:** Habitat Loss, Poaching of Wildlife and Man–Wildlife Conflicts, Endangered and Endemic Species of India. **Conservation of Biodiversity:** In-situ and Ex-situ Conservation.
Unit-III	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution and Nuclear Hazards. **Solid Waste Management:** Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies. **Disaster Management:** Floods, Earthquakes, Cyclones and Landslides. **Social Issues and the Environment:** From Unsustainable to Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rainwater Harvesting, Watershed Management, Resettlement and Rehabilitation of People, Problems and Concerns, Case Studies. **Environmental Ethics:** Issues and Possible Solutions, Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies, Wasteland Reclamation, Consumerism and Waste Products. **Environmental Legislation:** Environment Protection Act, Air Prevention and Control of Pollution Act, Water Prevention and Control of Pollution Act, Wildlife Protection Act, Forest Conservation Act, Issues Involved in Enforcement of Environmental Legislation, Public Awareness.
Unit-IV	**Human Population and the Environment:** Population Growth, Variation among Nations, Population Explosion, Family Welfare Programme, Environment and Human Health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies. **Field Work** (Equivalent to 10 Lecture Hours) • Visit to a Local Area to Document Environmental Assets—River, Forest, Grassland, Hill or Mountain. • Visit to a Local Polluted Site—Urban, Rural, Industrial or Agricultural. • Study of Common Plants, Insects and Birds. • Study of Simple Ecosystems—Pond, River, Hills, Slopes, etc.

Suggested Readings

- Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner
- The Biodiversity of India by Bharucha, MAP in Publishing Pvt.Ltd., Ahmedabad.
- Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc.,1989
- Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
- Global Biodiversity Assessment by V.H. Heywood & R.T.Watson, Cambridge University Press, 1995, 1140p.
- Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House, Delhi, 1995, 284p.
- Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
- Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd., 1987, 345p.
- Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut, 2001.
- Survey of the Environment, The Hindu.
- Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
- Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
- Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA, 1998, 499p.
- A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links

Unit No.	Topic	Link
I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

Course Code	**BSC-CE- 202B**				
Category	**Basic Science Course**				
Course Title	**Engineering Mathematics-III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are to make the students • To understand and apply fundamental mathematical methods for solving differential equations, numerical problems, and transform-based models. • To develop logical reasoning and analytical skills through discrete mathematics and algebraic structures for engineering and scientific applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamental concepts of engineering mathematics.	Level 1: Remember
CO2	Explain mathematical techniques used in engineering analysis.	Level 2: Understand
CO3	Apply mathematical methods to solve engineering problems.	Level 3: Apply
CO4	Analyze engineering problems using appropriate mathematical tools.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Partial Differential equations:** First order linear partial differential equations, First order non- linear partial differential equations, Charpit's method, Second order linear partial differential equations and their classifications, Method of separation of variables and its applications to wave equation, One dimensional heat equations and Two dimensional heat flow (steady state solutions only).
Unit-II	**Numerical methods:** Solution of Polynomial and Transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.
Unit-III	**Transform Calculus:** Laplace Transform, Properties of Laplace transform, Laplace transform of periodic functions, Inverse Laplace transform by different methods, Convolution theorem, Evaluation of integrals by Laplace transform, Solving ordinary differential equations by Laplace transform method.
Unit-IV	**Probability and Statistics:** Measures of central tendency, Moments, Skewness and Kurtosis, Basic concepts of Probability, Conditional probability, Baye's theorem, Random variables, Discrete random variables, Expectation of discrete random variables, Variance of a sum, Binomial distribution, Poisson distribution, Continuous random variables and their properties, Distribution functions, Normal Distribution.

Suggested Readings:

- Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publishing Company Limited.
- Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers.
- Numerical Methods by P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand and Company.
- Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning.
- A Textbook of Engineering Mathematics by N. P. Bali and Manish Goyal, Laxmi Publications.
- Satinder Bal Gupta: A Text Book of Discrete Mathematics and Structures, University Science Press, Delhi.

Useful Video Links

Unit No.	Topics	Links
Unit I	First order linear partial differential equations	https://youtu.be/vQFFShhNyPo?si=noaoVs9vpiRm9nD2
	First order non-linear partial differential equations, Charpit's method	https://youtu.be/kEN_Ze8QNdM?si=_cs7Qn3cpNV4QWEu
	Second order linear partial differential equations and their classifications	https://youtu.be/kEN_Ze8QNdM?si=Rq69griDh-Zzr7dn
	Method of separation of variables and its applications to wave equation	https://youtu.be/kEN_Ze8QNdM?si=wv6-dO0Ph3gyoycg
Unit II	Solution of Polynomial and Transcendental equations	https://youtu.be/3j0c_FhOt5U?si=ZOx4OqOnj4kycbRi
	Interpolation	https://youtu.be/rWyTk9eubKM?si=DeOVGwmD72myPGkp
	Numerical integration	https://youtu.be/iviiGB5vxLA?si=u4l274cZxDZSw9Wm
Unit III	Laplace Transform	https://youtu.be/OA1OJrfpP20?si=iiu38t0ChNja5IEb
	Laplace transform of periodic functions	https://youtu.be/MM3vi7mQ60U?si=G5HNHLP4X1cePeRu
	Inverse Laplace transform by different methods	https://youtu.be/EDVJotmT584?si=r_8HyZkyRlLVUPfb
	Solving ordinary differential equations by Laplace transform method	https://youtu.be/KaRx67h5xzk?si=otp94t8VjHzzE_in
Unit IV	Introduction of Probability	https://youtu.be/60vHy2lA4o4
	Discrete Random variable & Probability Distribution	https://youtu.be/Sv9UYnp9tbs?si=eHqwSJETA5SO3NFI
	Continuous Probability distribution	https://youtu.be/o2LB3KQME3U?si=NWaP0TY_K8tPaAfu
	Miscellaneous	https://onlinecourses.nptel.ac.in/noc22_ma81/preview

Course Code	**PCC-CE-204B**				
Category	**Professional Core courses**				
Course Title	**Hydraulic Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand principles of open channel flow and hydraulic machines. • To analyze flow characteristics in channels and pipelines. • To study performance of turbines and pumps. • To apply hydraulic principles in water resources engineering				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define basic concepts of hydraulic engineering.	Level 1: Remember
CO2	Describe problems related to various types of flow.	Level 2: Understand
CO3	Apply concepts to derive various equations for fluid.	Level 3: Apply
CO4	Analyze various types of flow.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Viscous Flow:** Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing, movement of piston in dash pot, methods of measurement of viscosity. **Module 2: Turbulent Flow:** Expression for coefficient of friction, Darchy-Weishbach Equation, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.
Unit-II	**Module 3: Hydraulic Turbines:** Classification of Turbines, Impulse and Reaction Principles, Pelton, Francis and Kaplan Turbines, Velocity Triangles, Unit Quantities, Specific Speed, Efficiencies, Characteristic Curves, Governing, Cavitation. **Module 4: Pumps:** Classification of Pumps, Centrifugal Pumps, Reciprocating Pumps, Axial Flow and Mixed Flow Pumps, Priming, Cavitation, Characteristic Curves, Selection of Pumps, Hydraulic Ram.
Unit-III	**Module 5: Flow in open channels:** Type of channels, classification of flows, continuity energy and momentum equation, concept of critical depth and specific energy, critical depth for rectangular, triangular, circular, and trapezoidal channels, flow through transition with a hump and with change in width (contraction and expansion).

	Module 6: Uniform flow: Chezy's equation, Manning's formula, Factors affecting Manning's roughness coefficient, velocity distribution, shear stress distribution, Uniform flow computations for rectangular, trapezoidal, and circular channels, standard line canal channels, Hydraulically efficient channel sections, compound sections, Critical slope, and limit slope,
Unit-IV	**Module 7: Gradually Varied Flow:** Classification of flow profiles (M, S, C, H, and A profiles), control sections, serial combination of channel sections, Transitional depth, numerical solution of gradually varied flow problems. **Module 8: Hydraulic jump:** Hydraulic jump in rectangular channel: sequent depth ratio, Energy loss; Classification of jumps, characteristics of jumps in rectangular channels, use of jump as an energy dissipater.

Suggested Readings

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth,
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
5. Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers, 1971
6. Fluid Mechanic and Hydraulic machines R.K. BANSAL

Useful Video Links

Unit No.	Topic	Link
Unit-I	Viscous Flow	https://youtu.be/0taaKGJ39X0?si=H-4A3yoItcyjZVTf
	Turbulent Flow	https://youtu.be/4w331Apz1j4?si=-GbJAAbruNEOmiBC
Unit-II	Fluid Machines	https://www.youtube.com/live/wSTiH1h6DWQ?si=0pOm9BU4lNmZgJQO
	Power Hydraulics	https://youtu.be/MNtLMqC9mJU?si=DZ4maC5VOBJELPMe
Unit-III	Flow in open channels	https://youtu.be/bjZ2bc8-gTE?si=oRrAqvSKvE-azUb-
	Uniform flow	https://www.youtube.com/live/54a8JR1lIaM?si=IgKSp2x3TYUGndRS
Unit-IV	Gradually Varied Flow	https://youtu.be/VsFnxqCKCqY?si=NcE4rLTwRLEIQaD_
	Hydraulic jump	https://www.youtube.com/live/nHHD60kAtd0?si=hhWMhR0FFg-sk0hX

Course code	**PCC-CE-206B**				
Category	**Professional Core course**				
Course title	**Structural Analysis**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To introduce analysis of determinate and indeterminate structures. • To develop ability to determine internal forces and deflections. • To apply classical methods for structural analysis. • To prepare students for design-oriented subjects.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Remember different structural analysis methods.	Level 1: Remember
CO2	Understand structural analysis methods.	Level 2: Understand
CO3	Apply analysis techniques to beams and frames.	Level 3: Apply
CO4	Analyze determine and indeterminate structures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**MODULE 1: Deflection of Statically determinate structures:** Elastic curve, slope and deflection of beams by Double Integration Method, Moment Area Method, Conjugate Beam Method and Unit Load Method, Maxwell's Reciprocal Theorem and Betti's Reciprocal Theorem. **MODULE 2: Deflection of Statically determinate Frame & Truss:** Principle of Virtual Work, strain energy due to axial force, bending, shear and torsion, Castigliano's First Theorem, determination of deflection in beams, pin-jointed trusses and rigid-jointed frames.
Unit-II	**MODULE 3: Influence Lines and Moving Loads:** Introduction to moving loads and influence lines; influence lines for support reactions, shear force, bending moment and member forces in statically determinate beams and plane trusses; Müller–Breslau Principle; analysis of moving concentrated loads, uniformly distributed loads and series of concentrated loads; maximum shear force, maximum bending moment, absolute maximum bending moment, Equivalent Uniformly Distributed Load (EUDL) and enveloping parabola.
Unit-III	**MODULE 4: Arches:** Theory and classification of arches, Eddy's Theorem, analysis of three-hinged circular and parabolic arches, radial shear, normal thrust and bending moment, horizontal thrust in three-hinged arches, effects of temperature and support settlement. **MODULE 5: Cable and Suspension Bridge:** Introduction of Cable and suspension Bridge uniformly loaded cables, Temperature stresses, and three hinged stiffening Girder and two hinged stiffening girder.

Unit-IV	**MODULE 6: Indeterminate Structures & Deflection methods:** Introduction to Indeterminate Structures, Determination of kinematic and static indeterminacy of beams, frames and trusses, Slope Deflection and Moment Distribution Methods- Analysis of continuous beams & portal frames, Portal frames with inclined members. **MODULE 7: Kani's and Column Analogy Method:** Elastic centre, properties of analogous column, application to beam & frames, Analysis of continuous beam and simple frames, Analysis of frames with different column lengths and end condition of the bottom storey.

Suggested Readings

- Statically Indeterminate Structures by C.K. Wang, McGraw Hill Book Co., New York.
- Advanced Structural Analysis by A.K. Jain, Nem Chand & Bros., Roorkee.
- Indeterminate Structures by R.L. Jindal, S. Chand & Co., New Delhi.
- Theory of Structures, Vol. I, by S.P. Gupta & G.S.Pandit, Tata McGraw Hill, New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Deflection of determinate beams by Double Integration Method	https://youtu.be/ajGlZCND4rM?si=aoKNyj9Pt3wtx4
II	Maximum Shear Force and Bending Moment diagrams for simply supported beams carrying moving loads	https://youtu.be/zYEjDnVnnHs?si=QeeacW9-z1E3ngNd
III	Determination of horizontal thrust, shear force and bending moment diagram for arches	https://youtu.be/F8u5zgdo_C4?si=UDm2Z14drPxvNf_d
IV	Indeterminate Structures & Deflection methods	https://youtu.be/8nGgpKz07yk?si=xcYNj-Qxs3NUVnHm

Course Code	PCC-CE-208B				
Category	Professional Core course				
Course Title	Advanced Surveying				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	The objectives of this course are: • To develop advanced knowledge of surveying methods such as triangulation, tacheometry, • To enable computation and adjustment of advanced survey data for engineering projects, • To introduce remote sensing and photogrammetry concepts for mapping applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall advanced surveying concepts, instruments, and terminology.	Level 1: Remember
CO2	Understand adjustment computations and RS principles.	Level 2: Explain
CO3	Apply modern surveying techniques.	Level 3: Apply
CO4	Analyze spatial and remote sensing data.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Triangulation and Trilateration:** Triangulation systems, classification, selection of triangulation stations, grades of triangulation, triangulation computations, Trilateration-Principle, Methods, advantages and disadvantages, introduction to total station. **Module 2: Survey Adjustment and Computations:** Definitions, types of error, weight of an observation, law of weights, most probable values, principle of least squares, normal equation.
Unit-II	**Module 3: Astronomy :** Definitions of astronomical terms, celestial coordinate systems, Napier's rule of circular parts, star at elongation, star at prime vertical, star at horizon, star at culmination, Astronomical triangle, various time systems, conversion of local time to standard time and vice versa. **Module 4: Elements of Photogrammetry :**Introduction, types of photographs, scale of a photograph, height displacements of vertical photographs, flight planning and its uses, crab and drift, number of photographs, relief displacements, height determination from parallax measurement, flight planning.
Unit-III	**Module 5: Introduction to Remote Sensing:** Definition of Remote Sensing, types of remote sensing, remote sensing system and components, active and passive remote sensing, EMR propagation, Atmospheric windows in Remote Sensing, Spectral signature, Satellite platforms: Geo-stationary and sun synchronous satellites, Applications of remote sensing in civil engineering.

Unit-IV	**Module 6: Geographic Information System (GIS):** Definition and objectives of GIS, components of GIS, linkage between spatial and non-spatial data, integration of Remote Sensing (RS) and GIS data, Digital Elevation Model (DEM), Introduction to GIS Softwares. **Module 7: Global Positioning System (GPS):** Introduction to GPS – Working Principle of GPS, components & types of GPS receivers, GNSS concepts, GPS, GLONASS, Galileo and NavIC, Components of GNSS, Differential GPS, Sources of errors, Positioning methods, Surveying applications, Infrastructure mapping.

Suggested Readings

- Chang.T.K. 2002: Geographic Information Systems, Tata McGrawHill
- Punmia, B.C. 2005: Surveying I and II, Luxmi Publications
- Paul R Wolf: Elements of Photogrammetry
- G S Srivastava: An introduction to Geoinformatics
- BasudebBhatta: Remote Sensing and GIS
- G. L. Hosmer: Text-book on Practical Astronomy

Useful Video Links

Unit No.	Topic	Link
Unit-I	Triangulation systems	https://www.youtube.com/watch?v=-23Rvzey1Ko
	Theory of Errors	https://www.youtube.com/live/WNmitfzV4RM?si=4weVoaPr4ctZ1dPl
Unit-II	Definitions of astronomical terms, celestial coordinate systems	https://youtu.be/14-YsGiCNwI?si=Vf44PAY6qm_u3wg9
Unit-III	Elements of Photogrammetry	https://youtu.be/qDmu_r12TU8?si=B6U5pXihH35NZ-dI
Unit-IV	Introduction to remote sensing	https://youtu.be/cn5CWu_zt_s?si=HF-xcIbvPwahitgF
	GIS and GPS	https://www.youtube.com/live/KEc0_IY5L0Y?si=YL5qGNd_HUoz6HCO

Course Code	**PCC-CE-210B**				
Category	**Professional Core course**				
Course Title	**Design of Concrete Structures**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To develop a comprehensive understanding of reinforced concrete design principles, including working stress and limit state methods, structural elements, reinforcement detailing, and foundation systems, • To apply, analyze, evaluate, and integrate their behavior, safety, stability, and serviceability requirements for efficient, durable, and sustainable structural design.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define and recall basic concepts of RCC design.	Level 1: Remember
CO2	Understand design philosophies.	Level 2: Understand
CO3	Apply RCC design methods.	Level 3: Apply
CO4	Analyze RCC structural elements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Design methodology and Working stress Method:** Introduction to Reinforced Concrete Design, Working Stress Method vs. Limit State Method, Building Codes and Design Philosophy, Characteristic strength and loads, Partial safety factors and factored load, Stress–strain relationship for concrete and steel, Basic assumptions of Working Stress Method, Permissible stresses in concrete and steel. **Module 2: Limit State Method:** Basic assumptions, Serviceability criteria **(**Control of deflection, Cracking, Slenderness and vibrations), Deflection and moment relationship for limiting values of span to depth, Limit state of crack width, Design examples.
Unit-II	**Module 3: Design of Beams:** Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirement and design examples using limit state and working stress methods. **Module 4: Shear Bond and Torsion:** Analysis and Design of Sections in shear, bond and torsion, Diagonal tension, shear reinforcement, Development length, Anchorage and flexural bond, Torsional stiffness, equivalent shear, Torsional reinforcement, Design examples.
Unit-III	**Module 5: Slabs:** General considerations, Design of one way and two ways slabs for distributed and concentrated loads, Non-rectangular slabs, Openings in slabs, Design Examples.

	Module 6: Stair Case: Various Types of Staircases, General Notes on Design of Stair, Design Examples.
Unit-IV	**Module 7: Columns:** Effective length, Minimum eccentricity, Short columns, under axial compression, Uniaxial and biaxial bending, Slender columns. Design examples. **Module 8: Footings:** Isolated and wall footings, Design examples. Foundations-Combined footings, raft foundation, design of pile cap and piles, under reamed piles, design examples.

Suggested Readings

1. Design of Reinforced Concrete Structures by P. Dayaratnam, Oxford & IBH Pub., N.Delhi.
2. Design of Reinforced Concrete-Limit State Design By A.K. Jain, Nem Chand & Bros., Roorkee.
3. Design of Reinforced Concrete by I.C. Syal & A.K. Goel, A.H. Wheeler & Co. Delhi
4. Reinforced Concrete Design by S.N. Sinha, Tmh Pub., N.Delhi.
5. Sp-16(S& T)-1980, Design Aids For Reinforced Concrete to IS:456, BIS, N. Delhi.
6. Reinforced cement concrete design by Neelam Sharma , S.K. Kataria &sons, N. Delhi.
7. Sp-34(S&T)-1987 Handbook on Concrete Reinforcement And Detailing, BIS, N. Delhi.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Working stress and limit state methods	https://youtu.be/ba3mZhOpsTM?si=cR5Ec7Nhv6-dHT2l
	Limit State of Collapse Flexure	https://youtu.be/zVKf6hZfrhA?si=S8Zye0KA-nBzqUW2
Unit-II	Design of Shear	https://youtu.be/AfHmpWlcqq4?si=d3bD-x_PV-ZKLORe
	Concrete Reinforcement and Detailing	https://youtu.be/aJJedgPfFVI?si=mYBTzapnJBW1Ksba
Unit-III	Design of Slab	https://youtu.be/PDJPcQq3PZE?si=1CxjrcXeHNHgWsll
	Design of one way and two ways slabs	https://youtu.be/PDJPcQq3PZE?si=2dEvG1hldX9Y2yvn
Unit-IV	Minimum eccentricity in column	https://youtu.be/ukIrYcFLyoc?si=FJLU2ajoaNQOg-y1
	Design of Footings	https://youtu.be/8ATp13mOhvg?si=nIau7l22DhUIhH8h

Course Code	**LC-PCC-CE-212B**				
Category	**Lab Course**				
Course Title	**Hydraulic Engineering Lab.**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To conduct experiments on open channel flow and hydraulic machines. • To evaluate discharge, velocity, and efficiency parameters. • To interpret hydraulic system performance.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the behavior of fluids.	Level 1: Remember
CO2	Understand the different types of flow.	Level 2: Explain
CO3	Calculate the flow characteristics.	Level 3: Apply
CO4	Analyze the flow characteristics.	Level 4: Analyze

List of Experiments

1. To determine the coefficient of drag by Stokes law for spherical bodies.
2. To study the phenomenon of cavitation in pipe flow.
3. To determine the critical Reynolds number for flow through commercial pipes.
4. To determine the coefficient of discharge for flow over a broad crested weir.
5. To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis including friction blocks.
6. To study the scouring phenomenon around a bridge pier model
7. To study the scouring phenomenon for flow past a spur.
8. To determine head loss due to various pipe fittings.

Useful Video links:

Exp. No	Experiment	Links
1	Coefficient of drag by Stokes' law	https://www.youtube.com/results?search_query=Stokes+Law+Experiment+Coefficient+of+Drag+Fluid+Mechanics
2	Cavitation in pipe flow.	https://www.youtube.com/results?search_query=Cavitation+in+Pipe+Flow+Laboratory+Experiment
3	Reynolds number	https://www.youtube.com/results?search_query=Reynolds+Number+Experiment+Fluid+Mechanics+Lab
4	Coefficient of discharge	https://www.youtube.com/results?search_query=Broad+Crested+Weir+Experiment+Coefficient+of+Discharge

Course Code	**LC-PCC-CE-214B**				
Category	**Lab Course**				
Course Title	**Structural Analysis Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To perform structural experiments and software-based analysis. • To understand structural behavior under various loading conditions. • To analyze experimental and analytical results				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall different methods of structural analysis.	Level 1: Remember
CO2	Understand various structural analysis theorems and principles.	Level 2: Explain
CO3	Examine behavior of structures under different loading conditions.	Level 3: Apply
CO4	Analyze behavior of structures under different loading conditions.	Level 4: Analyze

List of Experiments

1. To verify moment area theorem regarding slope and deflection in a beam
2. To verify Maxwell's Reciprocal Theorem.
3. Experiment on a two – hinged arch for horizontal thrust and influence line for horizontal thrust
4. Analytical and experimental study of three hinged arch
5. Experimental and analytical study of unsymmetrical bending of a cantilever beam
6. Sway in portal frames – Demonstration

Useful Video links:

Exp. No	Experiment	Links
1	Moment Area Theorem	https://www.youtube.com/results?search_query=Moment+Area+Method+Deflection+of+Beams+NPTEL
2	Maxwell's Reciprocal Theorem	https://www.youtube.com/results?search_query=Maxwell+Reciprocal+Theorem+Beam+Deflection
3	Two-Hinged Arch	https://www.youtube.com/results?search_query=Two+Hinged+Arch+Experiment+Horizontal+Thrust
4	Three-Hinged Arch	https://www.youtube.com/results?search_query=Three+Hinged+Arch+Laboratory+Experiment

Course Code	**LC-PCC-CE-216B**				
Category	**Lab Course**				
Course Title	**Advanced Surveying Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are to Use the theodolite for measuring angles and use of tacheometer to determine distance and elevation and to draw simple circular curves, to calculate base line measurement and importance of triangulation, to use a total station to measure distance, elevation and coordinates and to use total station to plot a map of given area with software.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	To study and use of theodolite for angle measurements.	Level 1: Remember
CO2	To use tachometer for horizontal and vertical distances.	Level 2: Explain
CO3	To draw simple circular curves.	Level 3: Apply
CO4	To measure base line measurement.	Level 4: Analyze

List of Experiments

1. Study various parts of a theodolite
2. Measurement of horizontal and vertical angles with theodolite.
3. Measurement of Tachometric constants
4. Calculating horizontal distance and elevations using tachometer
5. Exercise of triangulation including base line measurement.
6. Setting out simple circular curves by deflection angle method.
7. Study the various parts of a total station.
8. Measurements of distance, elevation, coordinate with total station.
9. Special problems with total station.

Useful Video links:

Exp. No	Experiment	Links
1	Measurement of horizontal and vertical angles with theodolite	https://youtu.be/Mb2jbdqMJHA?si=6x3x-rULjspFXrDa
2	Measurement of Tachometric constants.	https://youtu.be/-q_4kK2z3mA?si=gdgUlGi5hWAVo1aP
3	Calculating horizontal distance and elevations using tachometer.	https://youtu.be/cIZbyEaD_PA?si=DnjKIdUV2luMtqL0
4	Study the various parts of a total station.	https://youtu.be/oFoegb0lx3o?si=lExcfpB30KYnw9T_

Course Code	LC-PCC-CE-218B				
Category	Lab Course				
Course Title	Concrete Lab				
Scheme and Credits	L	T	P	Credits	Semester-IV
	0	0	2	1	
Course Objectives	The objectives of this course are • To perform laboratory tests on concrete, steel, and other materials. • To evaluate strength and durability characteristics. • To prepare comprehensive laboratory reports.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall testing methods and standards.	Level 1: Remember
CO2	Understand behavior and failure modes of materials.	Level 2: Understand
CO3	Perform laboratory tests on materials.	Level 3: Apply
CO4	Analyze test data to determine parameters.	Level 4: Analyze

List of Experiments

1. Mix proportioning of normal concrete as per IS 10262.
2. Slump test for workability of concrete.
3. Compaction factor test.
4. Vee-Bee consistometer test.
5. Flow table test.
6. Compressive strength test on concrete cubes.
7. Split tensile strength test on concrete cylinders.
8. Flexural strength test on concrete beams.
9. Water absorption and permeability test of hardened concrete.
10. Non Destructive Testing
11. Comparative study of concrete produced with different water-cement ratios.

Useful Video Links

Exp. No.	Experiment	Link
1	Mix Proportioning of Normal Concrete (IS 10262)	https://www.youtube.com/results?search_query=IS+10262+concrete+mix+design
2	Slump Test for Workability of Concrete	https://www.youtube.com/results?search_query=slump+test+of+concrete
3	Compaction Factor Test	https://www.youtube.com/results?search_query=compaction+factor+test+of+concrete
4	Vee-Bee Consistometer Test	https://www.youtube.com/results?search_query=Vee+Bee+consistometer+test
5	Flow Table Test	https://www.youtube.com/results?search_query=flow+table+test+of+concrete

6	Compressive Strength Test on Concrete Cubes	https://www.youtube.com/results?search_query=compressive+strength+test+of+concrete+cube
7	Split Tensile Strength Test on Concrete Cylinders	https://www.youtube.com/results?search_query=split+tensile+strength+test+of+concrete
8	Flexural Strength Test on Concrete Beams	https://www.youtube.com/results?search_query=flexural+strength+test+of+concrete+beam
9	Water Absorption and Permeability Test of Hardened Concrete	https://www.youtube.com/results?search_query=water+absorption+and+permeability+test+of+concrete
10	Non Destructive Testing	https://www.youtube.com/results?search_query=rebound+hammer+test+on+concrete
11	Comparative Study of Concrete with Different Water-Cement Ratios	https://www.youtube.com/results?search_query=effect+of+water+cement+ratio+on+concrete+strength

Course Code	**PEC-CE -220B**				
Category	**Professional Elective Course**				
Course Title	**Repair & Rehabilitation of Structure**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	• To understand deterioration, distress, and behavior of concrete structures. • To develop skills in damage assessment, testing, and selection of repair and strengthening techniques. • To learn maintenance, protection, and structural health monitoring for durable structures.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall different types of repair materials in concrete structures.	Level 1: Remember
CO2	Understand principles of repair and maintenance.	Level 2: Understand
CO3	Apply various testing techniques of repair and maintenance.	Level 3: Apply
CO4	Analyze structural failures and select suitable repair and strengthening methods.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction:** Overview of Distress, Deterioration in Concrete Structures, Global Scenario of Distressed Structures, Need for Repairs and Upgrading of Structures, Process for Durable Concrete Repair **Deterioration of concrete structures** :Types of Deterioration - causes & symptoms, mechanism & micro-structure of concrete, Physical and Chemical Deterioration and its factors, Deterioration due to Water Leakage, Fire – detection & mitigation, Deterioration due to Ageing and Inadequate Maintenance, Design & Construction Deficiencies like Overloading.
Unit-II	**Visual deterioration of structures** :Types of Cracks, Causes & Characteristic of Cracking in Various Structural Components, Measurement of Cracks and Interpretation of the Cracking Phenomena **Conditional/damage assessment & Evaluation of structures**: Structural Assessment-importance, objective, various stages, conditional evaluation of the structure, Damage Assessment Procedure, Preliminary & Detailed Investigation – scope, objectives, methodology & rapid visual inspection of structures , Damage Assessment Allied Tests (Destructive, Semi-Destructive and Non-Destructive), Field & Laboratory Testing Procedures- strength, corrosion activity, performance & Integrity, Durability.

Unit-III	**Repairs of concrete structures** :Repairing Materials- criteria, selection of repair materials, methodology, performance requirements, preparatory stage of repairs, different types of repair materials & their application and repair techniques **Retrofitting/Strengthening** :Need for Retrofitting, Design Philosophy of Strengthening Structures, Conventional and Advanced Techniques Available for Strengthening, Seismic Retrofit of Concrete Structures- deficiencies in structure requiring seismic retrofit and its design philosophy, Latest Techniques to Enhance the Seismic Resistance of Structures.
Unit-IV	**Protection & maintenance of structures** :Importance of Protection & Maintenance, Categories of Maintenance, Building Maintenance, Corrosion Mitigation Techniques **Structural health monitoring (SHM)** :Definition and Motivation for SHM, Basic Components of SHM and its Working Mechanism, SHM as a Tool for Proactive Maintenance of Structures

Suggested Readings

- Concrete microstructure, Properties and materials – P Kumar Mehta and Paulo J.M. Monterio.
- Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.
- Concrete Technology by M.L. Gambhir, Tata McGraw-Hill Education, Third Edition
- V. M. Malhotra, Nicholas J. Carino 2004 “Handbook on Nondestructive Testing of Concrete”
- “Repair and Strengthening of Concrete structures” , FIP guide, Thomas Telford, London.
- Concrete Structures, Protection, Repair and Rehabilitation by R.Dodge Woodson.
- Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Need for Repairs and Upgrading of Structures	https://youtu.be/x9noZ4xEXyg?si=fsAcIHU5CS-pVnoa
	Causes of Deterioration	https://youtu.be/IxFjLHOCgqw?si=i18xg0dUm9fDUVhj
Unit-II	Types of Cracks	https://youtu.be/3pcvb9cnih8?si=mT27C1-Ltuy8Se2o
	Non-Destructive Test	https://youtu.be/qjwYcEQcJ3I?si=AEVE5fPJJElfs7Vw
Unit-III	Selection of repair materials	https://youtu.be/JuRUXEV6Qmw?si=51hGoXj3JoXlHCwC
	Need for Retrofitting	https://youtu.be/1935UK8EU0U?si=RwEcgG9MOp95pOCl
Unit-IV	Importance of Protection & Maintenance	https://youtu.be/NUdvZcMnud8?si=oOVnOwHavxGWFf1U
	Basic Components of SHM and its Working Mechanism	https://youtu.be/sahuqWQO2-0?si=Br7LeULFcsbLE8hz

Course code	**PEC-CE-222 B**				
Category	**Professional Elective Courses**				
Course title	**Climate Hazards and Disaster Mitigation**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • Introduce fundamental concepts of climate science, climate change, and extreme weather events relevant to civil engineering. • Familiarize students with tools and techniques for observing, measuring, and analyzing climate extremes using climate data and models. • Develop analytical skills to detect trends, assess risks, and estimate return periods of extreme events affecting infrastructure systems.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic principles of climate science.	Level 1: Remember
CO2	Understand the basic principles of climate science.	Level 2: Understand
CO3	Apply climate data analysis techniques and concepts.	Level 3: Apply
CO4	Analyze uncertainties in climate extremes using different methods.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Climate Change and Natural Hazards:** Weather and Climate, Climate Change and Global Warming, Causes and Effects of Climate Change, Natural Hazards and Disasters, Floods, Droughts, Cyclones, Heat Waves, Cold Waves, Cloudbursts, Landslides, Climate Hazards in India. **Module 2: Hazard Assessment and Infrastructure:** Hazard, Vulnerability and Risk, Basic Hazard Assessment, Weather Forecasting and Early Warning Systems, Effects of Climate Hazards on Buildings, Roads, Bridges, Dams, Water Supply and Drainage Systems, Urban Flooding, Introduction to Climate-Resilient Infrastructure.
Unit-II	**Module 3: Mitigation and Adaptation Measures:** Structural and Non-Structural Mitigation Measures, Flood Control Measures, River Training Works, Slope Protection, Coastal Protection Measures, Drought Management, Water Conservation, Rainwater Harvesting, Nature-Based Solutions, Climate Adaptation. **Module 4: Disaster Management:** Disaster Management Cycle, Preparedness and Emergency Planning, Evacuation Planning, Basic Search and Rescue, Relief, Rehabilitation and Reconstruction, Build Back Better (BBB), Community Participation in Disaster Management.

Unit-III	**Module 5: Disaster Management Framework:** Disaster Management in India, National Disaster Management Authority (NDMA), State Disaster Management Authorities (SDMAs), National Disaster Management Plan (NDMP), Role of Government and Local Bodies, Sustainable Development Goals (SDGs). **Module 6: Technology in Disaster Management:** Role of Technology in Disaster Management, Sensor-Based Monitoring, Mobile-Based Warning Systems, Geographic Information System (GIS) Basics, Internet of Things (IoT) Applications, Artificial Intelligence (AI) Applications, Digital Communication during Emergencies.
Unit-IV	**Module 7: Climate-Resilient Civil Engineering:** Climate-Resilient Buildings, Roads and Bridges, Flood-Resilient Drainage Systems, Sustainable Construction Practices, Urban Resilience, Planning of Disaster-Resilient Infrastructure. **Module 8: Case Studies:** Case Studies of Major Climate Hazards (Floods, Cyclones, Heat Waves and Landslides) in India and Around the World, Impacts on Civil Infrastructure, Infrastructure Performance and Failures, Engineering Lessons and Best Practices for Disaster Mitigation.

Suggested Readings

- Intergovernmental Panel on Climate Change (IPCC). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). Cambridge University Press.
- Wilks, D. S. Statistical Methods in the Atmospheric Sciences. Academic Press.
- Coles, S. An Introduction to Statistical Modeling of Extreme Values. Springer.
- Kundzewicz, Z. W. (Ed.). Flood Risk in a Changing Climate. IAHS Press.
- Smith, K., & Petley, D. Environmental Hazards: Assessing Risk and Reducing Disaster. Routledge.
- Burroughs, W. J. Climate Change: A Multidisciplinary Approach. Cambridge University Press.

Useful Video Links

Unit No.	Topic	Link
I	Climate Science Basics.	https://youtu.be/dbJz1KBYVbg
II	Climate Data Sources and Observational Tools.	https://youtu.be/aeu95dlnwm4?si=ejHFSZ0Y8MHt9pRD
III	Case Studies on Recent Extreme Events.	https://youtu.be/ouQOuIavOzM?si=JaimE14L96p0oRa8
IV	Advances in Climate Extremes Research	https://youtu.be/-x35OzfPgRE?si=1cINNc77vV2hs019

Course Code	PEC-CE-224B				
Category	Professional Elective Courses				
Course Title	Material Testing and Evaluation				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand testing procedures of construction materials. • To determine mechanical properties of materials. • To evaluate material performance for structural applications. • To develop skills in interpreting laboratory test results.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define properties of materials.	Level 1: Remember
CO2	Understand behavior of materials under different loading conditions	Level 2: Understand
CO3	Apply the testing procedures of materials.	Level 3: Apply
CO4	Analyze test results of materials.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Module 1: Engineering Materials and Performance Characteristics**: Engineering properties of construction materials, Physical, Mechanical and Durability properties, Cement, Lime, Aggregates, Bricks, Blocks, Timber, Structural steel, Bituminous materials, Glass, Ceramics, Polymers, Composite materials, Material selection for engineering applications. **Module 2: Testing of Cementitious Materials:** Sampling procedures, Field identification, Laboratory testing of cement, Fineness, Standard consistency, Setting time, Soundness, Compressive strength, Testing of lime, Cement mortars, Lime mortars, Acceptance criteria, IS specifications.
Unit-II	**Module 3: Testing of Aggregates and Masonry Units:** Sampling techniques, Sieve analysis, Specific gravity, Water absorption, Bulk density, Aggregate crushing value, Aggregate impact value, Los Angeles abrasion, Flakiness and elongation index, Testing of bricks, Fly ash bricks, Concrete blocks, AAC blocks, Acceptance criteria. **Module 4: Concrete Testing and Quality Evaluation:** Properties of fresh concrete, Slump test, Compaction factor test, Vee-Bee consistometer test, Flow table test, Air content test, Properties of hardened concrete, Compressive strength test, Split tensile strength test, Flexural strength test, Modulus of elasticity, Water permeability test, Acceptance criteria as per IS specifications.

Unit-III	**Module 5: Testing of Steel, Timber and Bituminous Materials:** Mechanical properties of steel, Tensile, Bend, Re-bend and Hardness tests, Testing of structural steel sections, Timber testing, Moisture content, Bituminous material testing, Penetration, Softening point, Ductility, Viscosity, Flash and fire point tests. **Module 6: Concrete Mix Design and Durability Assessment:** Objectives of mix design, IS 10262 mix design procedure, Water-cement ratio, Aggregate grading, Workability requirements, Selection of admixtures, Sulphate attack, Chloride attack, Alkali-aggregate reaction, Carbonation, Corrosion of reinforcement, Durability enhancement measures.
Unit-IV	**Module 7: Non-Destructive Testing and Structural Evaluation:** Principles of NDT, Rebound hammer, Ultrasonic Pulse Velocity, Cover meter, Half-cell potential, Pull-out test, Core sampling, Interpretation of test results, Structural condition assessment, Residual strength evaluation, Limitations of NDT. **Module 8: Laboratory Quality Management and Advanced Material Evaluation:** Laboratory safety practices, Sampling and specimen preparation, Calibration of testing equipment, Precision and accuracy in testing, Recording and reporting of test results, Interpretation of test results, Acceptance criteria as per relevant IS specifications, Evaluation of recycled construction materials.

Suggested Readings

1. Handbook of mix design - BIS
2. Concrete Technology by M.S. Shetty.
3. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, Highway Materials and Pavement Testing, Nem Chand & Bros, Fifth Edition
4. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
5. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)

Useful Video Links

Unit No.	Topic	Link
Unit-I	**Introduction to Engineering Materials**	https://youtu.be/gqp3cNOp5yQ?si=qwMzQKxgcsh3T9Sf
	Types of cement and uses	https://youtu.be/oouvhVPnuqY?si=1AabzMz4U6x5Bkv2
Unit-II	**Properties of fresh and hardened concrete**	https://youtu.be/T4pjWFzd3rA?si=xaIqebkLO23CoIdk
	ACI mix design practice, USBR method	https://youtu.be/bHT1SySn6z4?si=Ob5S3FRnEk0v37lx
Unit-III	**Types of steel**	https://youtu.be/xaP0jaYoFvw?si=6SnKbQZfM2roP3L7
	Elasticity – principle and characteristics	https://youtu.be/bj9hE1L57mc?si=VvmBidzNcQQUBkh-
Unit-IV	**Testing of concrete mixes**	https://youtu.be/WfOsywEJGHU?si=pQDYzEeCw5SM2nIR
	Construction Equipments	https://youtu.be/2B7DhQvL8kw?si=4E0abrtJh0G9pA6X

Annexure AC/5.21

~~Annexure 4.6~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute
'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme & Syllabus

For

Minor/Honors Degree/Specialization

in

Green Technology & Sustainability Engineering

Department of Civil Engineering

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)
Scheme of Studies and Examination
Honors Degree in Green Technology & Sustainability Engineering
w.e.f. 2026-27

Sr. No.	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	GTSE-201B	Sustainable Engineering Concepts and Life Cycle Analysis	3	0	0	3	3	30	45		75	3
2	IV	GTSE-202B	Environmental Impact Assessment	3	0	0	3	3	30	45		75	3
3	IV	MOOC-I	MOOC-I (Broad Area Civil Engineering)					3				75	3
4	V	GTSE-301B	Building Materials as a Cornerstone to Sustainability	3	0	0	3	3	30	45		75	3
5	V	MOOC-II	MOOC-II (Broad Area Civil Engineering)					3				75	3
6	VI	GTSE-302B	Strategies for Sustainable Design	3	0	0	3	3	30	45		75	3
7	VI	MOOC-III	MOOC-III (Broad Area Civil Engineering)					3				75	3
8	VII	GTSE-401B	Admixtures and Special Concretes	3	0	0	3	3	30	45		75	3
9	VII	LGTSE-403B	Admixtures and Special Concretes Lab	0	0	2	2	1	10		15	25	
10	V	SM-GTSE-303B	Seminar	0	0	2	2	1	10		15	25	
11	VI	PROJ-GTSE-304B	Project	0	0	4	4	2	15		35	50	
Total Credits								**19**	**185**	**225**	**65**	**475**	

Note: To earn the required credits for the award of B.Tech. Minor/Honors (Hons.)/Specialization Degree, students may choose either:

i. To enroll in courses offered through NPTEL/MOOCs that must be equivalent to the prescribed courses in the approved scheme, subject to availability in any semester.

OR

ii. To complete the prescribed courses in the same semester as offered by the department under the approved scheme and curriculum structure.

iii. Students should take Massive Open Online Courses (MOOCs) approved by the concerned Chairperson Board of Studies (BoS)

Course Code	GTSE-201B				
Course Title	Sustainable Engineering Concepts and Life Cycle Analysis				
Scheme and Credits	L	T	P	Credits	Semester-III
	3	0	0	3	
Course Objectives	• To introduce the principles of sustainability and sustainable development. • To familiarize students with environmental, social, and economic aspects of engineering systems. • To develop understanding of Life Cycle Thinking and Life Cycle Assessment (LCA).				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall fundamental concepts of sustainability and sustainable development.	Level 1: Remember
CO2	Explain environmental, social, and economic dimensions of sustainability.	Level 2: Understand
CO3	Apply life cycle assessment tools to evaluate engineering systems and materials.	Level 3 : Apply
CO4	Analyze sustainability impacts and recommend suitable sustainable solutions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to Sustainability and Sustainable Development, Material Flow and Waste Management, Role of Engineers in Sustainable Development, Water-Energy-Food Nexus, Environmental Challenges and Resource Depletion, Introduction to Risk and Sustainability Framework.
Unit-II	Environmental Risk Assessment: Concepts and Methodology, Chemicals and Human Health Effects, Characterization of Environmental Problems, Environmental Data Collection and Monitoring, Statistical Analysis of Environmental Data, Common Analytical Instruments for Environmental Assessment.
Unit-III	Introduction to Life Cycle Thinking, Goal and Scope Definition, Life Cycle Inventory (LCI), Life Cycle Impact Assessment (LCIA), Life Cycle Interpretation, LCA Software Tools, ISO Framework for LCA, Data Quality and System Boundary Considerations, Benefits, Limitations and Applications of LCA.
Unit-IV	Design for Sustainability, Environmental, Economic and Social Sustainability Indicators, Sustainable Engineering Design Principles, Environmental Cost Analysis, Green and

	Sustainable Materials, Chemical Release, Fate and Transport, Case Studies: Odour Removal in Organics Treatment Plants, Comparison of Hand Drying Methods, Biofuels for Transportation, Kerosene Lamp vs Solar Lamp, Bioplastics and Sustainable Product Assessment.

Suggested Readings

- Allen, D. T., & Shonnard, D. R. (2011). Sustainable Engineering: Concepts, Design and Case Studies. Prentice Hall.
- Graedel, T. E., & Allenby, B. R. (2010). Industrial Ecology and Sustainable Engineering. Pearson Education.
- Guinée, J. B. (Ed.). (2002). Handbook on Life Cycle Assessment: Operational Guide to the ISO Standards. Springer.
- Hauschild, M. Z., Rosenbaum, R. K., & Olsen, S. I. (2018). Life Cycle Assessment: Theory and Practice. Springer.
- Muthu, S. S. (Ed.). (2021). Life Cycle Assessment for Sustainable Engineering. Springer.
- United Nations Environment Programme (UNEP). (2020). Guidelines for Social Life Cycle Assessment of Products and Organizations. UNEP.
- International Organization for Standardization (ISO). (2006). ISO 14040: Environmental Management—Life Cycle Assessment—Principles and Framework. ISO.
- International Organization for Standardization (ISO). (2006). ISO 14044: Environmental Management—Life Cycle Assessment—Requirements and Guidelines. ISO.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Sustainability Concepts – Innovations and Challenges	https://www.digimat.in/nptel/courses/video/127105018/L01.html?utm_source=chatgpt.com
	LCA and Water, Food and Energy Nexus	https://digimat.in/nptel/courses/video/105105157/105105157.html?utm_source=chatgpt.com
Unit-II	Risk Assessment and LCA Frameworks	https://digimat.in/nptel/courses/video/105105157/105105157.html?utm_source=chatgpt.com
Unit-III	Life Cycle Assessment – Introduction	https://www.digimat.in/nptel/courses/video/105105157/L01.html?utm_source=chatgpt.com
	Detailed LCA Methodology	https://klnce.digimat.in/nptel/courses/video/105105157/L16.html?utm_source=chatgpt.com
Unit-IV	Sustainable Engineering Design Principles	https://www.digimat.in/nptel/courses/video/105105157/L34.html?utm_source=chatgpt.com
	Life Cycle Thinking and Circular Economy	https://www.digimat.in/nptel/courses/video/127105018/L05.html?utm_source=chatgpt.com

Course Code	GTSE-202B				
Course Title	Environmental Impact Assessment				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	To develop an understanding of Environmental Management and EIA frameworks and to apply, analyze, and evaluate EIA procedures, tools, legal provisions, public participation, reporting, and decision-making processes for effective impact mitigation and Environmental Management Plan (EMP) preparation using practical case studies.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of Environmental Management, and EIA in environmental systems.	Level 1: Remember
CO2	Explain legal, policy, and regulatory frameworks governing Environmental Impact Assessment.	Level 2: Understand
CO3	Apply EIA procedures such as screening, scoping, baseline data collection, and appropriate methodologies.	Level 3 : Apply
CO4	Analyze environmental impacts using EIA methods, tools, techniques, and public participation processes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to Environment Management & EIA, Legal, Policy & Regulatory Framework, EIA Procedure - Scoping & Screening and Establishing Baseline Conditions.
Unit-II	EIA Methodologies: EIA Methods, Tools and Techniques.
Unit-III	Public Involvement in EIA, Impact Management - Mitigation & Preparation of Environment Management Plans (EMP), EIA Reporting & Review of EIA Quality.
Unit-IV	Decision Making & Project Management, Implementation & Follow up, EIA Case Examples.

Suggested Readings

- Canter, L. W. (1996). Environmental impact assessment (2nd ed.). McGraw-Hill.

- Glasson, J., Therivel, R., & Chadwick, A. (2012). Introduction to environmental impact assessment (4th ed.). Routledge.
- International Association for Impact Assessment. (1999). Principles of environmental impact assessment best practice. IAIA.
- Jay, S., Jones, C., Slinn, P., & Wood, C. (2007). Environmental impact assessment: Retrospect and prospect. Environmental Impact Assessment Review, 27(4), 287–300. https://doi.org/10.1016/j.eiar.2006.12.001
- Morris, P., & Therivel, R. (Eds.). (2009). Methods of environmental impact assessment (3rd ed.). Routledge.
- Noble, B. F. (2015). Introduction to environmental impact assessment: A guide to principles and practice (3rd ed.). Oxford University Press.
- Sadler, B. (1996). Environmental assessment in a changing world: Evaluating practice to improve performance. International Study of the Effectiveness of Environmental Assessment.
- Therivel, R., & Wood, G. (2018). Strategic environmental assessment (2nd ed.). Routledge.
- United Nations Environment Programme. (2002). Environmental impact assessment training resource manual. UNEP.
- United Nations Environment Programme. (2018). Assessing environmental impacts: A global review of legislation. UNEP.
- Wood, C. (2003). Environmental impact assessment: A comparative review. Longman Environmental Planning Series.
- World Bank. (1999). Environmental assessment sourcebook. World Bank Publications.
- Government of India, Ministry of Environment, Forest and Climate Change. (2006). Environmental Impact Assessment Notification. MoEFCC.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction to Environment Management & EIA	https://youtu.be/9-MEVIXr3Ko?si=oZXgYyr-G-U-fFyS
	EIA Procedure	https://youtu.be/8vymfIfip2w?si=jUTYSib0yriqSP7R
Unit-II	EIA Methodologies	https://youtu.be/6TgNwkYZg_8?si=Bhs6WQJmA4Xh_C7x
Unit-III	Public Involvement in EIA	https://youtu.be/NR2N57wFOog?si=YP9Bh7wtpbpf2NMj
	EIA Reporting & Review of EIA Quality	https://youtu.be/o70_CrRG62M?si=ELUVSjVcbTIDmPhR
Unit-IV	Decision Making & Project Management	https://youtu.be/ZJ8xTZKves4?si=UR60udr9-FqOzNDu
	EIA Case Examples	https://youtu.be/rAy-IviWh_M?si=vIiNrtaCABPGECow

Course Code	GTSE-301B				
Course Title	Building Materials as a Cornerstone to Sustainability				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	To develop a comprehensive understanding of conventional, alternative, innovative, advanced, and smart building materials, and to apply, analyze, evaluate, and integrate their properties, environmental impacts, and functional performance for sustainable and intelligent construction solutions..				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify and classify conventional, vernacular, and alternative building materials and their environmental issues.	Level 1: Remember
CO2	Explain the properties and sustainability aspects of traditional and waste-based building materials.	Level 2: Understand
CO3	Apply innovative and alternative materials for sustainable construction practices.	Level 3 : Apply
CO4	Analyze the performance and environmental benefits of advanced building materials.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to Building materials, their classification, environmental issues, Vernacular Materials, Mud- Traditional Material, Mud as a Building material.
Unit-II	Stone as a building Material, Thatch ,Bamboo, Binders Strawbale, Laterite Quarry Waste, Alternate building material Fly ash, Furnace Slag, Cross Laminated Timber, Construction and Demolition waste, Hempcrete, Phosphogypsum, Aerated Concrete, Alternate aggregate, Innovative Building Materials - Introduction.
Unit-III	Bio-luminescent paints, Milk Paints and Recycled Plastics, Agro bricks, Light emitting materials – concrete, CO_2 Absorbing Concrete, Mycelium Composite Bricks, Fibre Reinforced Concrete, Geo-polymer Concrete, Introduction to Advanced Building Materials, Carbon sequestration by building materials, Eco-bind Tiles, Permeable Concrete.
Unit-IV	Introduction to smart materials and its types, Facade systems: Smart Windows, Liquid Crystal Display, Photochromics, Thermochromic materials, Phase change materials, Adhesion changing smart materials, Photo adhesive smart materials, Titanium dioxide (tio2) products, Mechanochrmics, Thermochromics, Electrochromic, Nano cellulose composite bricks, electroluminescent, Recap and conclusions.

Suggested Readings

- Ashby, M. F. (2013). Materials and the environment: Eco-informed material choice (2nd ed.). Butterworth-Heinemann.
- Berge, B. (2009). The ecology of building materials (2nd ed.). Architectural Press.
- Binici, H., Aksogan, O., Shah, T., & Eken, M. (2015). Investigation of fibre reinforced mud brick as a building material. Construction and Building Materials, 78, 318–325. https://doi.org/10.1016/j.conbuildmat.2014.12.093
- Bouhadda, Y., et al. (2019). Bio-based building materials and carbon sequestration. Journal of Cleaner Production, 221, 841–855. https://doi.org/10.1016/j.jclepro.2019.02.156
- Calkins, M. (2012). Materials for sustainable sites: A complete guide to the evaluation, selection, and use of sustainable construction materials. Wiley.
- Chandra, S., & Berntsson, L. (2003). Lightweight aggregate concrete: Science, technology, and applications. William Andrew Publishing.
- Davies, J. (2011). Building with earth: Design and technology of a sustainable architecture. Birkhäuser.

Useful Video Links

Unit No.	Topic	Link
Unit-I	**Introduction to Building materials**	https://youtu.be/8AwTVpfgcE0?si=gP1kQ-QfvI195gdm
	Mud as a Building material	https://youtu.be/X9OaNXfyj_Y?si=ijbVQHrwPMISi2ln
Unit-II	**Laterite Quarry Waste**	https://youtu.be/S6NSABtlpao?si=7EmhO4V37vTPd5yP
	Bamboo	https://youtu.be/4M9Ay4L7gXk?si=VxtN5WiOTpBzH_mS
Unit-III	**Light emitting materials**	https://youtu.be/ey_sFm5luWQ?si=5oOY6AeVh7VwQ8Yj
	Introduction to Advanced Building Materials	https://youtu.be/mTBa--U7K_o?si=yR6jldGGtQ_Q-f89
Unit-IV	**Adhesion changing smart materials**	https://youtu.be/djS5z1JmEjQ?si=b_UAoex8xEHxZKrT
	Introduction to smart materials and its type	https://youtu.be/-ibRO0iVknQ?si=SSiU4-aJqTqh9XoP

Course Code	GTSE-302B				
Course Title	Strategies for Sustainable Design				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	To analyze sustainability concepts and environmental issues in built and industrial systems, evaluate policies, standards and life-cycle impacts, and create responsible, energy-efficient and human-centric design solutions aligned with SDGs and emerging sustainable practices.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define and recall fundamental concepts of sustainability, sustainable development, environmental, social and economic (ESE) dimensions, and global sustainability frameworks..	Level 1: Remember
CO2	Explain sustainability concepts, ESE aspects, climate change, pollution and energy dependence.	Level 2: Understand
CO3	Apply 3R principles, conventions, and human comfort strategies for sustainable built environments.	Level 3 : Apply
CO4	Analyze environmental impacts, vernacular responses, and ecosystem health through design alternatives	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	ESE Aspects of Sustainability and Climate Change Mitigation, Current National and International Scenario of SD and Dependence on Energy.
Unit-II	Impact of Pollutions and Design Processes with Alternative Solutions for Health of Ecosystem, Policy, Growth, Development and 3R's for Consumption.
Unit-III	NBC, ECBC, and SA Methods such as GRIHA ,UN SDG and System Design tools, Vernacular and Responsive Design using Net-Zero Energy, Lighting, Ventilation, Views, etc., for Human Comfort.
Unit-IV	Design for Sustainability and Nature as Inspiration, International Conventions, Laws and Emerging Technologies for SD,SD Case Studies and Summary.

Suggested Readings

- Ashby, M. F. (2013). Materials and the environment: Eco-informed material choice (2nd ed.). Butterworth-Heinemann.
- Bhamra, T., & Lofthouse, V. (2007). Design for sustainability: A practical approach. Gower Publishing.
- Brundtland, G. H. (1987). Our common future. Oxford University Press.

- Cabeza, L. F. (Ed.). (2014). Life cycle assessment (LCA) and energy analysis of buildings and the built environment. Elsevier.
- Charter, M., & Tischner, U. (2001). Sustainable solutions: Developing products and services for the future. Greenleaf Publishing.
- Fiksel, J. (2015). Design for environment: A guide to sustainable product development (2nd ed.). McGraw-Hill.
- Givoni, B. (1998). Climate considerations in building and urban design. Van Nostrand Reinhold.
- Intergovernmental Panel on Climate Change. (2022). Climate change 2022: Mitigation of climate change. Cambridge University Press.
- International Organization for Standardization. (2006). ISO 14040: Environmental management—Life cycle assessment—Principles and framework. ISO.
- Kibert, C. J. (2016). Sustainable construction: Green building design and delivery (4th ed.). Wiley.

Useful Video Links

Unit No.	Topic	Link
Unit-I	**Introduction of Strategies for Sustainable Design**	https://youtu.be/2NEluSrn6fY?si=FZqjgi_7Ms1M82fP
	Perspectives on Sustainability in Industrial Design	https://youtu.be/KzKM1Il7O3g?si=BxApBV02RWn7N4BT
Unit-II	**Impact of Pollutions**	https://youtu.be/_DtVX1OQPnk?si=rTAZIoYZM8O15DmC
	Environmental Impact Assessment	https://youtu.be/xPO1qIZOtY0?si=kyi_bTMpKpaw55LX
Unit-III	**System Design tools**	https://youtu.be/BWJCsgXTFdY?si=rqxwpPYf8nCf5Mgg
	UN SDG	https://youtu.be/rHF7Uzto5Ug?si=xtYxTPQsQZYz43nC
Unit-IV	**Nature as Inspiration**	https://youtu.be/4-fKQ9EuJWE?si=vSQ9hYyMW5YqUbL-
	Laws and Emerging Technologies for SD	https://youtu.be/Hud_D_AT27A?si=DQEjRtGrjGatbScw

Course Code	GTSE-401B				
Course Title	Admixtures and Special Concretes				
Scheme and Credits	L	T	P	Credits	Semester-VII
	3	0	0	3	
Course Objectives	To provide students with knowledge of cement chemistry, admixtures, and special concretes so they can design and evaluate high-performance and sustainable concrete mixes for modern construction.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of cement and components of concrete.	Level 1: Remember
CO2	Explain the role and effects of chemical and mineral admixtures in concrete.	Level 2: Understand
CO3	Use admixtures and mix design techniques to improve concrete performance.	Level 3 : Apply
CO4	Analyze the rheology and properties of special concretes under different conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Cement and concrete performance - An overview.
Unit-II	Chemical admixtures: Introduction & Water reducers, Set controllers, Standards on chemical admixtures & Air entraining agents, Understanding concrete rheology, Viscosity modifying agents, Shrinkage reducing admixtures, & Other specialty admixtures.
Unit-III	Mineral Admixtures: Introduction, classification and pozzolanic activity, Fly ash and Silica fume, GGBFS, Metakaolin and LC3, Agricultural ashes, characterization techniques Life Cycle Assessment.
Unit-IV	Special Concretes: High strength concrete and ultra high performance concrete, Self compacting concrete and mass concreting and lightweight concrete, High density concrete and concrete for 3D printing.

Suggested Readings

- Aïtcin, P.-C. (2000). High-performance concrete. CRC Press.
- American Concrete Institute. (2010). ACI 212.3R: Report on chemical admixtures for concrete. ACI.
- American Concrete Institute. (2017). ACI 234R: Guide for the use of silica fume in concrete. ACI.
- American Concrete Institute. (2018). ACI 233R: Slag cement in concrete and mortar. ACI.
- Bentur, A., &Mindess, S. (2007). Fibre reinforced cementitious composites (2nd ed.). CRC Press.

- Hewlett, P., & Liska, M. (Eds.). (2019). Lea's chemistry of cement and concrete (5th ed.). Butterworth-Heinemann.
- Malhotra, V. M., & Mehta, P. K. (1996). Pozzolanic and cementitious materials. Gordon and Breach.
- Mehta, P. K., & Monteiro, P. J. M. (2014). Concrete: Microstructure, properties, and materials (4th ed.). McGraw-Hill Education.
- Neville, A. M. (2011). Properties of concrete (5th ed.). Pearson Education.

Useful Video Links

Unit No.	Topic	Link
Unit-I	**Introduction**	https://youtu.be/rJSxTY6u9NU?si=sg3Kzo4kXw-81aMj
	Cement chemistry and concrete performance	https://youtu.be/z21gfQ9zItE?si=WbhA2L_el6XWGfCm
Unit-II	**Chemical admixtures: Introduction**	https://youtu.be/eUhnvguuA2M?si=FzkjiE9w1DTctXiM
	Water reducers	https://youtu.be/OJbd1Z2OA_s?si=lCipvYkDaNOasbzl
Unit-III	**Mineral Admixtures: Introduction**	https://youtu.be/IfeGqnXOGmg?si=J3f9ZWwTSD2IczFv
	Fly ash and Silica fume	https://youtu.be/_VuCMDbKKXg?si=YWlwx-wXzTqKwEXe
Unit-IV	**Self compacting concrete**	https://youtu.be/h6dUtWHlG5I?si=cTNlIq3wauyCk0ai
	High density concrete and concrete for 3D printing	https://youtu.be/Ge0ZdmmHPBg?si=hXpxIceem3Pzh8Kc

Course code	**LGTSE-403B**				
Course title	**Admixtures and Special Concretes Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VII**
	0	0	2	1	
Course Objectives:	To enable students to understand materials and admixtures used in concrete, perform practical mix procedures, analyze concrete behavior, and evaluate suitable solutions for modern construction				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Identify materials and admixtures used in concrete.	Level 1:Remember
CO2	Describe the effect of admixtures on concrete behavior.	Level 2:Understand
CO3	Perform practical concrete mix preparation and testing.	Level 3:Apply
CO4	Analyze test results of fresh and hardened concrete.	Level 4:Analyze

LIST OF EXPERIMENTS

1. Study of cement chemistry and concrete performance.
2. Work-ability tests using water-reducing and set-controlling admixtures.
3. Testing of air-entraining admixtures and air content.
4. Rheology tests using viscosity and shrinkage-reducing admixtures.
5. Pozzolanic activity test of fly ash and silica fume.
6. Strength test of concrete with GGBFS, Meta-kaolin and LC3.
7. Characterization of agricultural ashes with basic LCA study.
8. Preparation and testing of special concretes (HSC, SCC, lightweight, high-density, 3D-printing).

Useful Video links:

Exp. No	Topics	Links
1	Work-ability tests using water-reducing and set-controlling admixtures.	https://youtu.be/B16svG4QrzY
2	Pozzolanic activity test of fly ash and silica fume.	https://youtu.be/biDjGm7J9q8
3	Strength test of concrete with GGBFS	https://youtu.be/0QqJqiMM2FQ?si=OC_xg5hSup7Y_roY
4	Preparation and testing of special concretes	https://youtu.be/-Ld6_jVBld8

Course code	**SM-GTSE-303B**				
Course title	**SEMINAR**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives:	Upon successful completion of this course, students will be able to: • To enable students to identify and study emerging topics related to sustainable and green infrastructure in civil engineering. • To develop the ability to review and analyze scientific literature, technical reports, and case studies related to sustainability in the built environment. • To enhance students' technical writing, presentation, and communication skills through preparation of seminar reports and presentations. • To encourage students to critically evaluate modern technologies, materials, and practices used for sustainable infrastructure development.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam					

COURSE CONTENT

During the semester, the students have to:

- Select a topic related to Sustainable and Green Infrastructure, such as sustainable building materials, environmental impact assessment, sustainable design strategies, smart cities, special concretes, or other emerging technologies in civil engineering.
- Conduct a comprehensive literature review on the selected topic using research papers, technical reports, standards, and relevant case studies.
- Analyze and summarize the sustainability aspects, environmental impacts, and practical applications of the selected topic.
- Prepare and deliver a technical seminar presentation highlighting objectives, methodology, findings, and future scope.
- Submit a detailed seminar report based on the literature review and analysis.
- Students are encouraged to prepare a review/technical paper based on their work for possible presentation or publication in a national conference, international conference, or journal, if feasible.

<table>
<tr><td>Course code</td><td colspan="5">PROJ-GTSE-304B</td></tr>
<tr><td>Course title</td><td colspan="5">PROJECT</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td>Course Objectives:</td><td colspan="5">Upon successful completion of this course, students will be able to:
• To enable students to apply the concepts of sustainable and green infrastructure to solve real-world civil engineering problems.
• To develop the ability to identify, analyze, and formulate engineering problems related to sustainable materials, environmental management, smart infrastructure, and sustainable design.
• To provide experience in research methodology, literature review, data analysis, modelling, design, or experimental investigation related to sustainable infrastructure systems.
• To enhance students' skills in teamwork, project planning, and technical problem solving while executing a project under faculty guidance.</td></tr>
<tr><td>Class work</td><td colspan="5">15 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">35 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5"></td></tr>
</table>

The objective of Project Work is to enable students to undertake an in-depth study on a topic related to Sustainable and Green Infrastructure, integrating knowledge from environmental impact assessment, sustainable materials, smart cities, sustainable design strategies, and advanced concretes. The project may involve theoretical, experimental, analytical, design-based, or field-oriented work under the guidance of a faculty supervisor from the department and, where possible, in collaboration with industry or research organizations.

The assignment should normally include:

1. Selection and in-depth study of a topic related to sustainable and green infrastructure such as sustainable construction materials, environmental assessment, smart urban systems, sustainable design, special concretes, or related emerging technologies.
2. Comprehensive literature review using research papers, technical reports, standards, and case studies to understand the current developments in the selected area.
3. Identification and formulation of the problem, including defining objectives, scope, methodology, and preparation of an action plan for carrying out the study.
4. Detailed analysis/design/modelling/simulation/experimental investigation related to the selected problem, emphasizing sustainability, environmental performance, and practical applicability.
5. Development and evaluation of proposed solutions, including data analysis, interpretation of results, and discussion on sustainability benefits and limitations.

6. Preparation of a technical/review paper based on the project work for possible presentation in a conference or publication in a journal, if feasible.
7. Preparation and submission of a detailed project report/dissertation in the prescribed format for evaluation by the department.
8. Final seminar presentation and demonstration of the project work before a departmental committee.

Annexure AC/5.22

DEPARTMENT OF ELECTRICAL ENGINEERING
GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

An Autonomous Institute | NAAC 'A' Grade Institute | Affiliated to MDU, Rohtak

Minutes of 4th meeting of Board of Studies (BOS) of Electrical Engineering Department

The 4th meeting of Board of Studies of Electrical Engineering Department was held on 08.06.2026 at 11:00 A.M in the Conference Hall of the Institute.

The following members were present for the BOS meeting:

SN	Name of the Member	Affiliation/Organization	Designation within Board of Studies
1	Dr. Joginder Singh	HOD, GITAM, Kablana	Chairperson
2	Dr. Naresh Kumar Yadav	Subject Expert (Professor, DCRUST Murthal), Outside Parent University	Member
3	Dr. Vipin Kumar	Subject Expert (Assistant Professor, UIET, MDU Rohtak), University Nominee	Member
4	Dr. Naveen Kaushik	Assistant Professor, GITAM Kablana	Member
5	Mr. Abhishake Jain	Assistant Professor, GITAM Kablana	Member
6	Mr. Brijesh	Assistant Professor, GITAM Kablana	Member
7	Mr. Ajay Lakra	Assistant Professor, GITAM Kablana	Member
8	Ms. Parul Gautam	Assistant Professor, GITAM Kablana	Member
9	Ms. Sonali Negi	Assistant Professor, GITAM Kablana	Member
10	Mr. Ankush Tyagi	Assistant Professor, GITAM Kablana	Member
11	Ms. Deepika	Assistant Professor, GITAM Kablana	Member
12	Mr. Ishu	Assistant Professor, GITAM Kablana	Member
13	Mr. Amit Goyal	Industry/ Corporate Sector (Balaji Transformers)	Member
14	Mr. Rajesh Sharma	Alumni	Member

At the outset the Chairperson welcome all the members present in the meeting. The point wise agenda was discussed as follows:

Item 4.1 Confirmation of the minutes of 3rd meeting of the Board of Studies of Electrical Engineering Department held on 26.12.2025.

To confirm the minutes of 3rd meeting of the Board of Studies of Electrical Engineering Department held on 26.12.2025 **(Annexure 4.1 Pages 1-4 already circulated).**

RESOLVED THAT THE MINUTES OF 3RD MEETING OF THE BOARD OF STUDIES OF ELECTRICAL ENGINEERING DEPARTMENT HELD ON 26.12.2025 (ANNEXURE 4.1 PAGES 1-4 ALREADY CIRCULATED) BE CONFIRMED.

Item 4.2 Follow-up action report on the decisions taken in the 3rd meeting of the Board of Studies of Electrical Engineering Department held on 26.12.2025.

To note the follow-up action on the decisions taken in the 3rd meeting of the Board of Studies of Electrical Engineering Department in the meeting held on 26.12.2025 **(Annexure 4.2 Pages 5 already circulated).**

RESOLVED THAT THE FOLLOW-UP ACTION ON THE DECISIONS TAKEN IN THE 3RD MEETING OF THE BOARD OF STUDIES OF ELECTRICAL ENGINEERING DEPARTMENT HELD ON 26.12.2025 (ANNEXURE 4.2 PAGES 5 ALREADY CIRCULATED) BE NOTED.

Item 4.3 Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Electrical Engineering) 3rd Year *w.e.f.* 2026-27.

The Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Electrical Engineering) 2nd year was approved by BOS in its meeting held on 27.05.2025 which was approved by Academic Council. The proposed Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Electrical Engineering) 3rd year *w.e.f.* Academic Session 2026-27 is attached as **Annexure 4.3 Pages 6-60.**

The BOS may consider and approve the Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Electrical Engineering) 3rd year.

RESOLVED THAT THE BOS CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (A-SCHEME) OF B.TECH (ELECTRICAL ENGINEERING) OF 3RD YEAR. (ANNEXURE 4.3 PAGES 6-60)

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.4 Syllabi of Open Elective Courses offered by Electrical Engineering Department for B.Tech. 3rd Year (Scheme-A) effective from the Academic Session 2026–27.

To approve the syllabi of the Open Elective Courses offered by Electrical Engineering Department for B.Tech. 3rd Year (Scheme-A) **(Annexure 4.4, Pages 61-62)** effective from the Academic Session 2026–27.

Sr. No.	Course Code	Course	Offered by	Departments Eligible to Choose the Course
1	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
2	---------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

RESOLVED THAT THE SYLLABI OF OPEN ELECTIVE COURSES OFFERED BY ELECTRICAL ENGINEERING DEPARTMENT AS MENTIONED ABOVE FOR B.TECH. 3RD YEAR (SCHEME-A), EFFECTIVE FROM THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.4, PAGES 61- 62) BE APPROVED.

FURTHER RESOLVED THAT THE APPROVED SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.5 Scheme of Studies & Examinations and Syllabi Common for B.Tech (Electrical Engineering) and B.Tech (Electrical Engineering-Working Professionals) 2nd year (B-Scheme as per NEP-2020) *w.e.f.* 2026-27.

The Institute has implemented the NEP-2020 *w.e.f.* 2025-26 (For 1st Year). The Scheme of Studies & Examinations and Syllabi is revised accordingly Common for B.Tech (Electrical Engineering) and B.Tech (Electrical Engineering-Working Professionals) for 2nd Year *w.e.f.* Academic Session 2026-27 is attached as **Annexure 4.5 Pages 63-118 and Scheme is named as B Scheme as per NEP-2020.**

The BOS may consider and approve the Scheme of Studies & Examinations and Syllabi (B-Scheme) for 2nd year Common for B.Tech (Electrical Engineering) and B.Tech (Electrical Engineering-Working Professionals).

RESOLVED THAT THE BOS CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (B-SCHEME) COMMON FOR B.TECH (ELECTRICAL ENGINEERING) AND B.TECH (ELECTRICAL ENGINEERING-WORKING PROFESSIONALS).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.6 Scheme of Studies & Examinations and Syllabi of Minor Degree/Honors (Hons.)/Specialization in "Electric Vehicles" (B-Scheme as per NEP-2020) from Academic Session 2026-27.

The Scheme of Studies & Examinations and Syllabi is revised accordingly for Minor Degree/Honors (Hons.)/Specialization in "Electric Vehicles" (B-Scheme as per NEP-2020) from Academic Session 2026-27. **(Annexure 4.6 Pages 119-133).**

The BOS may consider and approve the Scheme of Studies & Examinations and Syllabi for Minor Degree/Honors (Hons.)/Specialization in "Electric Vehicles" (B-Scheme as per NEP-2020).

RESOLVED THAT THE BOS CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI OF MINOR DEGREE/HONORS (HONS.)/SPECIALIZATION IN "ELECTRIC VEHICLES" (B-SCHEME AS PER NEP-2020) FROM ACADEMIC SESSION 2026-27.

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUIDES & EXAMINATIONS AND SYLLABI OF THE MINOR/HONS. DEGREE PROGRAM IN ELECTRIC VEHICLES IS RECOMMENDED TO ACADEMIC COUNCIL FOR APPROVAL.

Item 4.7 Review of Panel of Examiners for Practical Exams and Theory Paper Setting for B.Tech (Electrical Engineering) and M.Tech (Electrical Power Systems)

The BOS, in its meeting held on 26.12.2025 vide its Reso. No 3.6 has approved the Panel of Examiners **(Annexure 4.7 Page 134-135).** The BOS may now review the existing panel to ensure the inclusion of additional eligible and qualified examiners, if required, to further strengthen the evaluation process for the upcoming academic year.

RESOLVED THAT THE PANEL OF EXAMINERS REVIEWED AND APPROVED BY BOS. FURTHER RESOLVED THAT THE SAME IS SENT TO THE CONTROLLER OF EXAMINATIONS FOR FURTHER NECESSARY ACTION.

Item 4.8 Any Other Item with the permission of Chair

No other item was discussed in the meeting.

Dr. Jogiander Singh
Chairperson, Board of Studies
Department of Electrical Engineering
Ganga Institute of Technology and Management, Jhajjar

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies & Examinations & Syllabus For

Bachelor of Technology (Electrical Engineering)

(Effective from the Session: 2025-26)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	1 Practical (P) per week	0.5 Credit
4	2 Practical (Lab) per week	1 Credit

2. RANGE OF CREDIT

A range of credits from 160 to 170 for a student to be eligible to get Under Graduate degree in Electrical Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B. TECH)

Sr. No.	Category	Breakup of Credits
1	Basic Science Courses	21
2	Engineering Science Courses	22
3	Professional Core Courses	71
4	Professional Elective Courses	12
5	Humanities and Social Courses including Management Courses	12
6	Multidisciplinary Open Electives Courses	9
7	Value Added Courses	3
8	Project	4
9	Industrial Training	16
10	Mandatory Non-Credit Courses – Audit Course	(Non-Credit)
	Total Credits	**170**

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Basic Science Courses	BSC
2	Engineering Science Courses	ESC
3	Professional Core Courses	PCC
4	Professional Elective Courses	PEC
5	Humanities and Social Sciences including Management courses	HSMC
6	Multidisciplinary Open Electives Courses	OEC
7	Value Added Courses	VAT
8	Laboratory Courses	LC
9	Mandatory Non-Credit Courses (Audit Course)	MC
10	Project	PR
11	Practical Training	PT
12	Internship	INT

Scheme of Studies and Examination
B.Tech (Electrical Engineering) – 5th Semester
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Courses	PCC-EE-301A	Power Systems-I	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	PCC-EE-303A	Control Systems	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	PCC-EE-305A	Microprocessor and Microcontroller	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	PCC-EE-307A	Signals and Systems	3	0	0	3	3	40	60		100	3
5	Professional Electives Courses	--------	Refer Table-II	3	0	0	3	3	40	60		100	3
6	Humanities and Social Science including Management Courses	HSMC-01A	Fundamentals of Management & Organisational Behaviour	3	0	0	3	3	40	60		100	3
7	Professional Core Courses / (Lab Course)	LC-EE-309A	Power Systems-I Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses (Lab Course)	LC-EE-311A	Control Systems Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses (Lab Course)	LC-EE-313A	Microprocessor and Microcontroller Lab	0	0	2	2	1	25		25	50	3
10	Practical Training	PT-EE-315A	Evaluation of Summer Internship	0	0	2	2	1	25		25	50	3
		TOTAL CREDIT						**23**				**800**	

Notes:

I. Students must choose one course from the Professional Elective Courses category (Table-II). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table II (Professional Elective Courses)

S.No.	Course Code	Course
1	PEC-EE-317A	Digital Signal Processing
2	PEC-EE-319A	Power System Protection
3	PEC-EE-321A	Power System Stability
4	PEC-EE-323A	Power System Planning and Reliability

Note: Students have to select any one course from the above list, provided that the course has not been studied earlier.

Scheme of Studies and Examination
B.Tech (Electrical Engineering) – 6th Semester
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Courses	PCC-EE-302A	Power System-II	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	PCC-EE-304A	Power Electronics	3	1	0	4	4	40	60		100	3
3	Professional Core Courses	PCC-EE-306A	Electric Power Generation	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	PCC-EE-308A	Computer Aided Electrical Machine Design	3	0	0	3	3	40	60		100	3
5	Professional Electives Courses	----------	Refer Table-III	3	0	0	3	3	40	60		100	3
6	Open Elective Courses	----------	Refer Table-IV	3	0	0	3	3	40	60		100	3
7	Professional Core Courses (Lab Courses)	LC-EE-310A	Power System-II Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses (Lab Courses)	LC-EE-312A	Power Electronics Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses (Lab Courses)	LC-EE-314A	Computer Aided Electrical Machine Design Lab	0	0	2	2	1	25		25	50	3
10	Mandatory Courses	MC-301A	Essence of Indian Traditional Knowledge	2	0	0	-	0	40		60		3
		TOTAL CREDIT						**23**				**750**	

Notes:

I. MC-301A is a mandatory non –credit course in which the students will be required passing marks in theory. However, these marks will not be added in the total marks.

II. They may also opt for Massive Open Online Courses (MOOCs) offered through SWAYAM, SWAYAM Plus, or NPTEL platforms subject to approval by the concerned Chairperson, Board of Studies (BoS)/Head of the Department.

III. At the end of 6th semester, each student has to undergo Practical Training of 4/6 weeks in the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and its evaluation shall be carried out in the 7th Semester.

IV. Students must choose one course from the Professional Elective Courses category (Table III) and one course from the Multidisciplinary Open Elective Courses category (Table IV). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table III (Professional Elective Courses)

S.No.	Course Code	Course
1	PEC-EE-316A	Power Management
2	PEC-EE-318A	Renewable Energy Converters
3	PEC-EE-320A	Advanced Control Systems
4	PEC-EE-322A	Power Quality and FACTS

Note: Students have to select any one course from the above list, provided that the course has not been studied earlier.

Table IV (Multidisciplinary Open Elective Courses)

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

Course Code	**PCC-EE-301A**				
Category	Professional Core Courses				
Course Title	**Power System-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To make the students familiar with the fundamental concepts of power systems including three-phase networks, per unit system, and power representation. • To develop the understanding of students in fault analysis using symmetrical components and grounding practices in power systems. • To familiarize the students with switchgear, protection schemes, and their applications in ensuring system reliability and safety. • To make the students learn about modern power system aspects including DC transmission, solar PV systems, and wind energy conversion systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, components, and representations used in power systems including three-phase networks, fault analysis, protection schemes, and renewable energy systems.	Level 1: Remember
CO2	Explain the principles of power system analysis, fault behavior, protection mechanisms, and operation of DC transmission and renewable energy systems.	Level 2: Understand
CO3	Apply methods to determine fault currents, and demonstrate the use of protection schemes and renewable energy interfaces.	Level 3: Apply
CO4	Classify power system conditions, faults, protection schemes, and transmission methods to analyze their performance and interrelationships.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Basic Concepts: Introduction, Review of Three-phase systems. Analysis of simple three phase circuits. Single-phase representation of balance three-phase network, The one-line diagram and the impedance or reactance diagram, Per unit (PU) system, Complex power, The steady state model of synchronous machine, Transmission of electric power, Representation of loads.

Unit-II

Fault Analysis: Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding.

Unit-III

Switchgear and protection: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

Unit-IV

Introduction to DC Transmission & Solar PV systems: DC Transmission Systems: Line Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines. Permanent Magnetic Synchronous Generators and Induction Generators.

Suggested Readings:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
4. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012
6. EHV-AC/DC Transmission System; S. Rao: Khanna Pub.
7. C.L Wadhwa, "Electrical Power system" new age publication.
8. Power System Protection & Switchgear by B. Ram, McGraw Hill

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to Power System Analysis	https://nptel.ac.in/courses/108105067
	Single line diagram, PU system	https://www.youtube.com/watch?v=dmNlW2q-tbI
UNIT-II	Balanced fault analysis,	https://www.youtube.com/watch?v=24X4znh4nl0&list=PL36A60B630E8C7B56&index=26
UNIT-III	Attributes of Protection schemes	https://www.youtube.com/watch?v=WPmOB31UTkI&list=PLbRMhDVUMngef3WZI2VcPeBUALq989427
UNIT- IV	DC Transmission Systems	https://www.youtube.com/watch?v=yP7OACmLP48

Course Code	**PCC-EE- 303A**				
Category	Professional Core Courses				
Course Title	**CONTROL SYSTEMS**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with the fundamental concepts of control systems including modelling, transfer functions, and system representations. • To develop the understanding of students in analyzing time response, stability, and performance of control systems. • To familiarize the students with frequency response techniques and stability assessment methods in control systems. • To make the students learn about controller design, compensation techniques, and state space analysis of control systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, models, and techniques used in control systems including system representation, stability, frequency response, and controller design.	Level 1: Remember
CO2	Discuss the behavior of control systems in time and frequency domains, including stability, response characteristics, and control strategies.	Level 2: Understand
CO3	Determine system response, stability, and performance using time domain, frequency domain, and state space techniques.	Level 3: Apply
CO4	Analyze control system performance, stability, and design approaches based on system parameters, compensators, and controller configurations.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Control Systems: Mathematical modelling of electrical and mechanical systems, Feedback Control, Open-Loop and Closed-loop systems, Significance of feedback system, Transfer function models of linear time-invariant systems, Block diagram reduction technique and signal flow graphs.

Unit-II

Transient State and Steady State Analysis: Standard test signals, time response of first-order systems, characteristic equation of feedback control systems, transient response of second-order systems, time domain specifications, steady-state response, steady-state errors and error constants.

Stability analysis: Stability, Routh-Hurwitz stability criterion, relative stability, Concept of root locus, development of root loci, rules for construction of root locus, root movements under closed-loop operation, effects of poles and zeros on root locus, stability analysis using root locus.

Unit-III

Frequency Response: Relationship between time and frequency response, Closed-loop Frequency response, Frequency-domain specifications analysis using Bode plots, Gain margin and phase margin, Nyquist plot (Polar Plot), Use of Nyquist stability criterion for stability analysis.

Unit-IV

Compensator and Controller Design: Feedback compensation –Lead, Lag and Lead –Lag compensation, design of P, I, D, PD, PI, PID error control strategies, impact on transient response and steady-state response.

State variable Analysis: Concepts of state variables, State space model, Solution of state equations, Eigen values and Stability Analysis, Concept of controllability and Observability.

Suggested Readings:

1. N.S. Nise, "Control System Engineering", 7th Edition, 2015, Wiley Publications.
2. K. Ogata, "Modern control engineering", 5th Edition, 2010, Prentice Hall.
3. F. Golnaraghi, and B.C Kuo, "Automatic control systems" 9th Edition, 2008, Prentice Hall.
4. I.J. Nagrath and M.Gopal, "Control Systems Engineering", 5th Edition, 2009, New Age Publishers.
5. D' Azzo and Houpis, "Linear Control Systems Analysis and Design", 5th Edition, 2003, McGrow Hill.
6. R.C. Dorf, and R.H. Bishop, "Modern Control systems", 12th Edition, 2011, Addison-Wesley.
7. S. Hasan Saeed, "Automatic Control System", Katson Publications, 2008.
8. B. S. Manke, "Linear Control Systems with MATLAB Applications", Khanna Publications.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Open & Closed Loop Systems	https://www.youtube.com/watch?v=xQKcBugAIy4&list=PLxn52v8fxX5l5tGzU1NAxRDkgqxK0k5UZ&index=5
UNIT-II	Time Response (1st & 2nd Order)	https://www.youtube.com/watch?v=kbjCGGTXqUo&list=PLxn52v8fxX5l5tGzU1NAxRDkgqxK0k5UZ&index=9
UNIT-III	Routh-Hurwitz Criterion.	https://www.youtube.com/watch?v=cez4InLZ7Pw&list=PLxn52v8fxX5l5tGzU1NAxRDkgqxK0k5UZ&index=17
UNIT-IV	Lead & Lag Compensation.	https://www.youtube.com/watch?v=pTTTOuUps7I&list=PLxn52v8fxX5l5tGzU1NAxRDkgqxK0k5UZ&index=25
	PID Controller Design.	https://www.youtube.com/watch?v=bUYzLCwAoCQ&list=PLxn52v8fxX5l5tGzU1NAxRDkgqxK0k5UZ&index=31

Course Code	**PCC-EE-305A**				
Category	Professional Core Course				
Course Title	**Microprocessor and Microcontroller**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To make the students familiar with the fundamentals of microprocessors, their architecture, instruction sets, and programming concepts. ● To develop the understanding of students in peripheral devices, memory organization, and interfacing techniques in microprocessor systems. ● To familiarize the students with microcontroller architectures, features, and processor design approaches. ● To make the students learn about 8051 microcontroller programming and its real-time interfacing applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, architectures, instruction sets, peripheral devices, and features of microprocessors and microcontrollers.	Level 1: Remember
CO2	Explain the working of microprocessor and microcontroller systems, including memory organization, interfacing, and architectural differences.	Level 2: Understand
CO3	Demonstrate programming and interfacing techniques using microprocessors and microcontrollers for solving real-time problems.	Level 3: Apply
CO4	Classify microprocessor and microcontroller systems, architectures, memory schemes, and interfacing methods based on performance and application requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Microprocessors and Programming: Introduction to Microprocessors: Evolution, 8-bit/16-bit (8085/8086), Architecture, Pin configuration, addressing modes and Register organization of 8085.

8086 Architecture: Pin configuration, register organization, Addressing Modes, Memory Segmentation, Instruction Set of 8086, Minimum/Maximum Mode, Assembly language programming of 8086.

Unit-II

Peripheral Devices: Parallel Peripheral Interface (8255), Timer / Counter (8254), Programmable Interrupt Controller (8259), USART (8251), DMA Controller (8237) **Memory Concepts**: Cache Memory, Virtual Memory–Mapping and Access Mechanisms.

Unit-III

Introduction of Microcontroller: Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers, Processor Architectures: Harvard V/S Princeton, CISC V/S RISC Architecture and Microcontrollers memory types. **Microcontroller's features**: Clocking, I/O pins, Interrupts, Timers, Peripherals.

Unit-IV

Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

Suggested Readings:

1. Microprocessors and interfacing by D. V. Hall, TMH, 2nd Edition.
2. Microprocessor 8086: Architecture, Programming and Interfacing by Sunil Mathur, PHI Publisher
3. Microprocessors and Microcontrollers by Sunil Mathur, Jeebananda Panda, PHI Publisher
4. Advanced Microprocessors and Peripherals Architectures, Programming and Interfacing by Ray A. K. and Burchandi, TMH.
5. The Intel Microprocessors 8086- Pentium Processor by Brey, 8th Edition, Pearson Education.
6. The X86 PC: Assembly Language, Design and interfacing by M. A. Mazidi, J. P. Maizidi and Danny Causey, 5th Edition, Pearson Education.
7. Microcontrollers: Architectures, Programming, Interfacing and System Design by Raj Kamal, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Microprocessors and Interfacing –	https://www.youtube.com/playlist?list=PLdlPA9pGVVtaUwRP-2Eaux10vo_USuDy1
Unit-II	8255 Programmable Peripheral Interface: Block Diagram and Working Explained	https://www.youtube.com/watch?v=JCAjbuvvXbA
Unit-III	Von Neumann vs. Harvard Architecture: Understanding the Key Differences	https://www.youtube.com/watch?v=YiZy6vfgtHU
Unit-IV	8051 Microcontroller and Interfacing, The 8051 Microcontroller and Embedded Systems	https://www.youtube.com/playlist?list=PLEPI1RnS5drMCNu1VPDwdrRO_U0awwTxJ

Course Code	**PCC-EE-307A**				
Category	Professional Core Courses				
Course Title	**Signals and Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with the fundamental concepts of signals, systems, and their mathematical representations. • To develop the understanding of students in Fourier transforms and their applications in signal analysis. • To familiarize the students with time domain and frequency domain analysis of continuous-time and discrete-time systems. • To make the students learn about Laplace and Z-transform techniques for analysis and solution of system equations.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, types of signals, system properties, and transform techniques used in signal and system analysis.	Level 1: Remember
CO2	Discuss the representation and analysis of signals and systems in time and frequency domains using Fourier, Laplace, and Z-transform techniques.	Level 2: Understand
CO3	Apply transform methods to analyze signals, determine system responses, and solve differential and difference equations.	Level 3: Apply
CO4	Analyze signals and systems based on their properties, transform domains, and system characteristics to interpret their behavior.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Signals: Definition, types of signals and their representations: continuous-time, discrete-time, periodic, non-periodic, even, odd, energy, power, deterministic, random, one-dimensional, multidimensional, Shifting and scaling operations, Linear Time Invariant and Causal systems; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step unit ramp (and their inter-relationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables).

Unit-II

Fourier Transforms (FT): (i) Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT (ii) Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT, Sampling theorem, Applications of Fourier Transform.

Unit-III

Time and frequency domain analysis of systems: Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter.

Unit-IV

Laplace-Transform (LT) and Z-transform (ZT): (i) One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC) (ii) One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping.

Suggested Readings:

1. Signal and Systems' I J NAGRATH, R. RANJAN & Sharan, 2009 Edn., TMH, New Delhi
2. V. Oppenheim, A.S. Willsky and S. Hamid Nawab, 'Signals & System',PEARSON Education, Second Edition, 2003.
3. Signals & System by A Anand Kumar, Third edition PHI.
4. Schaume Series on Signals & Systems, HSU & RANJAN, TMH,India

Useful Video links

Unit No.	Topic	Link
UNIT-I	Power of Signals	https://youtu.be/gr1VqIYiMqQ?list=PLUQpHm_JtukKp93SX0nKToqHPsumsD-cP
UNIT-II	Fourier Transform	https://youtu.be/xBVsp1aoga4?list=PLUQpHm_JtukKp93SX0nKToqHPsumsD-cP
UNIT-III	Properties of Discrete Time LTI System	https://youtu.be/lDTSXFc9AeE?list=PLuv3GM6-gsE0WgB_q3tI2Gat_PEjQhF8o
UNIT- IV	Laplace Transform	https://youtu.be/TSkHT5solVM?list=PLuv3GM6-gsE0WgB_q3tI2Gat_PEjQhF8o

Course Code	**HSMC-01A**				
Category	Humanities and Social Science including Management Courses				
Course Title	**Fundamental of Management and Organizational Behaviour**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • Introduce students to foundational management theories, functions, and organizational concepts to build a strong conceptual framework. • Develop understanding of individual and group behavior, motivation, communication, and leadership in organizational settings. • Equip students with practical skills to manage interpersonal processes, conflicts, and team dynamics effectively. • Foster critical analysis of organizational structures, cultures, and change mechanisms to enhance adaptability and effectiveness in organizations.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental management concepts, functions, organizational processes, and organizational behavior elements.	Level 1: Remember
CO2	Explain the roles, skills, and interrelationships in management, individual behaviors, group dynamics, and communication processes within organizations.	Level 2: Understand
CO3	Apply principles of management, motivation techniques, leadership styles, and conflict management strategies to solve organizational behavior challenges.	Level 3: Apply
CO4	Analyze organizational structure, culture, change processes, and behavioral dynamics to support effective decision-making and organizational development.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction of Management: Meaning, Definitions, Nature of Management; Managerial Levels, Skills and Roles in an Organization.

Functions of Management: Planning, Organizing, Staffing, Directing & Controlling, Interrelationship of Managerial Functions, Scope of Management, Importance of Management, Difference between Management and Administration.

Unit-II

Introduction of Organization: Meaning and Process of Organization, Management v/s Organization.
Fundamentals of Organizational Behavior: Concepts, Evolution, Importance and Relationship with other Fields, Contemporary Challenges and Opportunities of OB.
Individual Processes and Behavior: Personality, Concept, Determinants and Applications.
Perception: Concept, Process and Applications
Learning: Brief Introduction
Motivation: Concept, Techniques and Importance

Unit-III

Interpersonal Processes: Teams and Groups, Definition of Group, Stages of Group Development, Types of Groups, Meaning of Team, Merits and Demerits of Team, Difference between Team and Group, Conflict-Concept, Sources, Types, Management of Conflict.
Leadership: Concept, Function, Styles, Qualities of Leadership.
Communication: Meaning, Process, Channels of Communication, Importance and Barriers of Communication.

Unit-IV

Organizational Processes: Organizational Structure, Meaning and Types of Organizational Structure and their effect on Human Behavior.
Organizational Culture: Elements, Types and Factors affecting Organizational Culture.
Organizational Change: Concept, Types and Factors affecting Organizational Change, Resistance to Change.

Suggested Readings:

1. Fundamentals of Management by Robbins, S.P. and Decenzo, Pearson Education, New Delhi.
2. Organizational Behaviour by Robbins, S.P. & Judge, T.A., Prentice Hall of India, New Delhi.
3. Management concept practice and cases by Ghuman Karminder, Aswathappa K., Tata McGraw Hill, New Delhi
4. Fundamental of Management by Chhabra T. N., Sun India Publications, New Delhi.
5. Organizational Behaviour by Stephen P Robin, Pearson Education.
6. Organizational Behaviour by McShane, Steven L, Tata McGraw Hill, New Delhi.
7. Organizational Behaviour by FC Sharma, Shree Mahavir Publications.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Nature and Scope of Management	https://nptel.ac.in/courses/110105146
UNIT-II	Perception and Personality	https://nptel.ac.in/courses/110103433
UNIT-III	Group Dynamics	https://archive.nptel.ac.in/courses/110/106/110106145/
UNIT- IV	Organizational Change, Resistance to Change.	https://nptel.ac.in/courses/110105146

Course code	**LC-EE-309A**				
Category	Professional Core Courses (Lab Course)				
Course title	**Power System-I Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Provide practical understanding of sequence reactance, fault analysis, and protective relays used in power system protection. • Study transmission line behavior including Ferranti effect and voltage distribution in high-voltage long transmission lines. • Develop understanding of photovoltaic module characteristics and wind energy conversion system.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the operating principles and characteristics of protective relays, transmission line phenomena, insulating oil testing equipment.	Level 2: Understand
CO2	Determine sequence reactances, fault currents, relay characteristics, and short-circuit currents of power system components using hardware setups and simulation tools.	Level 3: Apply
CO3	Analyze the behavior of power systems under symmetrical and unsymmetrical fault conditions by interpreting fault current patterns and system responses using simulation studies.	Level 4: Analyze
CO4	Assess the operating characteristics of photovoltaic and wind energy conversion systems.	Level 5: Evaluate

List of Experiments

Sr. No.	**Content**
	Hardware Based
1	To determine negative and zero sequence reactance of an alternator.
2	To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation.
3	To study the IDMT over current relay and determine the time current characteristics.
4	To study percentage differential relay.
5	To study Impedance, MHO and Reactance type distance relays.

6	To study Ferranti effect and voltage distribution in H.V. long transmission line using transmission line model.
7	To study operation of oil testing set.
8	To assess PV modules and their characteristics like open circuit voltage, short circuit current, Fill factor, Efficiency.
9	To assess I-V and P-V characteristics of PV module with varying radiation and temperature level.
10	To assess the I-V and P-V characteristics of series and parallel combination of PV modules.
11	To assess wind energy generation concepts like tip speed, torque and power relationship, wind speed versus power generation.
	Simulation software Based
12	To obtain steady state, transient and sub-transient short circuit currents in an alternator.
13	To perform symmetrical fault analysis in a power system.
14	To perform unsymmetrical fault analysis in a power system.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To determine negative and zero sequence reactance of an alternator.	https://vp-dei.vlabs.ac.in/Dreamweaver/exp3.html
To study percentage differential relay	https://vp-dei.vlabs.ac.in/Dreamweaver/exp10.html
To study Ferranti effect and voltage distribution in H.V. long transmission line using transmission line model	https://vp-dei.vlabs.ac.in/Dreamweaver/exp9.html
To study operation of oil testing set.	https://vp-dei.vlabs.ac.in/Dreamweaver/exp4.html
To understand PV modules and their characteristics like open circuit voltage, short circuit current, Fill factor, Efficiency,	https://ep-iitb.vlabs.ac.in/exp/characteristics-solar-cell/theory.html
To obtain steady state, transient and sub-transient short circuit currents in an alternator	https://vp-dei.vlabs.ac.in/Dreamweaver/exp8.html
Symmetrical short circuit analysis	https://vlabsdev.in/labs/vpl/sym-3phase/
Unsymmetrical short circuit analysis	https://vlabsdev.in/labs/vpl/unsym-3lg/

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course code	**LC-EE-311A**				
Category	Professional Core Courses (Lab Course)				
Course title	**CONTROL SYSTEMS LAB**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are ● Analyze behavior of control systems using response and frequency plots. ● Understand sensors and actuators used in control applications. ● Apply control techniques (P, I, D, compensators) to improve performance. ● Study and implement feedback and closed-loop control systems				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the operating principles and characteristics of servo motors, stepper motors, and control devices in closed-loop system.	Level 2: Understand
CO2	Demonstrate Bode plots, root locus diagrams, and compensator for given control system.	Level 3: Apply
CO3	Analyze the effect of addition of poles and zeros on the transfer function and closed-loop stability of a control system.	Level 4: Analyze
CO4	Evaluate the performance of PID controllers and closed-loop systems.	Level 5: Evaluate

List of Experiments

Sr. No.	**Content**
1	To study speed Torque characteristics of A.C servo motor.
2	To study speed Torque characteristics of D.C servo motor.
3	To demonstrate simple motor driven closed loop DC position control system.
4	To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.
5	To study and demonstrate simple closed loop speed control system.
6	To obtain the Operational Characteristics for the Control Application of the following devices. (i) Stepper Motor, (ii) Temperature Detectors.
7	To study control action of light control device.
8	To implement a PID controller for temperature control of a pilot plant.
9	Determination of the Incremental Transfer Function of an AC Servomotor.
10	Study the effect of addition of zeros to the forward path transfer function of a closed loop system.

11	Study the effect of addition of poles to the forward path transfer function of a control system.
12	To obtain bode plot for a given transfer function of the system.
13	To obtain root locus for a given transfer function of the system.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To obtain bode plot for a given transfer function of the system.	https://ce-dei.vlabs.ac.in/exp/to-obtain-bode-plot-for-a-given-transfer-function-of-the-system/
To obtain root locus for a given transfer function of the system.	https://ce-dei.vlabs.ac.in/exp/to-obtain-root-locus-for-a-given-transfer-function-of-the-system.
Study the effect of addition of poles to the forward path transfer function of a control system.	https://ce-dei.vlabs.ac.in/exp/study-the-effect-of-addition-of-poles-to-the-forward-path-transfer-function-of-a-control-system/
To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.	https://ce-dei.vlabs.ac.in/exp/pole-zero-plot/
To obtain the Position Control performance of DC Servo Motor.	https://vlabs.iitkgp.ac.in/ctrl/Exp4/index.html
Study the effect of addition of zeros to the forward path transfer function of a closed loop system.	https://ce-dei.vlabs.ac.in/exp/study-the-effect-of-addition-of-zeros-to-the-forward-path-transfer-function-of-a-closed-loop-system/

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course Code	**LC-EE-313A**				
Category	Professional Core Courses (Lab Course)				
Course Title	**Microprocessor and Microcontroller Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand architecture and working of Microprocessor and Microcontroller. ● To learn assembly programming for arithmetic and data operations. ● To provide hands-on experience in interfacing various peripherals with processor based systems.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the architecture and functioning of microprocessors and microcontroller using model kits and instruction sets.	Level 2: Understand
CO2	Apply interfacing techniques to connect peripherals with computing devices for practical applications.	Level 3: Apply
CO3	Analyze embedded control algorithms for hardware interfacing and timing operations using microcontroller kit.	Level 4: Analyze
CO4	Develop and debug assembly language programs for arithmetic, logical, and data manipulation tasks using instruction sets.	Level 5: Evaluate

List of Experiments

Sr. No.	Content
1	To study the architecture and functional blocks of the 8085 and 8086 microprocessors using trainer kit.
2	Write and execute program to perform arithmetic operations such as addition, subtraction, multiplication and division using 8085 instruction set.
3	Write a program to add the content of the memory location to the content of other memory location and store the result in 3rd memory location using 8086 instruction set.
4	Write a program to add 16 bit number using 8086 instruction set.
5	Write a program for multiplication of two 16 bit numbers using 8086 instruction set.
6	Write a program for division of two 16 bit numbers using 8086 instruction set.
7	Write a program to calculate the factorial of a given number using the 8086 instruction set.
8	Write a program to find the average of two given numbers using the 8086 instruction set.
9	Write a program to find the largest number in a data array using 8086 Instruction set.
10	Write and execute an 8086 assembly language program to interface and control a stepper motor using the 8255 (PPI).

11	To study the architecture and functioning of the 8051 microcontroller using trainer kit.
12	Write and execute a program to generate a square wave using the 8051 microcontroller.
13	Write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Virtual Lab Links:

Sr. No.	Topics	Links
1	Introduction of Microprocessor 8086 Trainer Kit	https://www.youtube.com/watch?v=GZibA34SU0c
2	Write a program to find the average of two given numbers using the 8086-instruction set.	https://www.youtube.com/watch?v=nOt9Wa-ClRo&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=10
3	Write a program to find the largest number in a data array using 8086 Instruction set.	https://www.youtube.com/watch?v=vNRGKG8ujVc&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=12
4	Write a program to calculate the factorial of a given number using the 8086-instruction set.	https://www.youtube.com/watch?v=riliLJP0Q_0&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=13
5	To write and execute an 8086-assembly language program to interface a stepper motor using 8255 PPI and control its rotation.	https://www.youtube.com/watch?v=lj5L1nGZAwg
6	To write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.	https://www.youtube.com/watch?v=aGVn4xGrAfY

Course Code	**PT-EE-315A**				
Category	Practical Training				
Course Title	**Evaluation of Summer Internship**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are to • To introduce circuit simulation using industry-standard software tools for electronic analysis. • To study technical documentation, engineering processes and industry standards in real-world projects. • To demonstrate professional communication, time management and ethical practices in industrial settings. • to analyze engineering problems and develop solutions using industry-standard tools and methodologies.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the organizational structure, working environment, and industrial practices of the training organization.	L2: Understand
CO2	Apply engineering knowledge to understand real-time industrial processes, tools, equipment, and systems.	L3: Apply
CO3	Prepare and present a technical training report based on observations, learning, and industrial exposure.	L3: Apply
CO4	Analyze practical problems encountered during training and relate them to theoretical concepts studied in the curriculum.	L4: Analyze

Note:

1. Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the V semester.
2. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

<table>
<tr><td>Course Code</td><td colspan="5">PEC-EE-317A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Digital Signal Processing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To make the students familiar with the fundamental concepts of discrete-time signals, systems, sampling, and z-transform techniques used in digital signal processing.
• To develop the understanding of students in frequency domain representation and analysis of discrete-time signals and systems using DFT and FFT techniques.
• To familiarize the students with the principles and methods of digital filter design and performance evaluation.
• To make the students learn about the implementation of discrete-time systems, spectral analysis, multirate signal processing, and their practical applications.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, transforms, frequency-domain techniques, filter structures, and multirate processing methods used in digital signal processing.	Level 1: Remember
CO2	Discuss the representation, analysis, filtering, implementation, and sampling rate conversion of discrete-time signals and systems.	Level 2: Understand
CO3	Apply transform-based methods, frequency-domain techniques, and filter design procedures for the analysis and processing of discrete-time signals.	Level 3: Apply
CO4	Analyze discrete-time systems, digital filters, implementation structures, spectral estimation methods, and multirate processing techniques based on their characteristics and performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

Unit-II

Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parseval's Identity.

Unit-III

Design of Digital Filter: Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

Unit-IV

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice 42 structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice Ladder Structures for IIR systems, Representation of fixed point and floating-point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks.

Suggested Readings:

1. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. S.K. Mitra, Digital Signal Processing: A computer based approach. TMH
4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya; TMH
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
7. D.J. DeFatta, J. G. Lucas and W.S. Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to Systems	https://youtu.be/sGu_YhiyE?list=PLUQpHm_JtukLkIO7QB6dp3KITCOM0ChGq
UNIT-II	Discrete time Fourier transform	https://youtu.be/zxFbujk_2f8?list=PLUQpHm_JtukLkIO7QB6dp3KITCOM0ChGq
UNIT-III	IIR Filters	https://youtu.be/Bdw3XcXgHa8?list=PLgMDNELGJ1CYvviJ_ZHrHy5TKLb-Vn7-r
UNIT- IV	Digital Filters Bank	https://youtu.be/ewmZ0qXVXfM

<table>
<tr><td>Course code</td><td colspan="6">PEC-EE-319A</td></tr>
<tr><td>Category</td><td colspan="6">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Power System Protection</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The objectives of this course are to
• To make the students familiar with the fundamental principles and components of power system protection, including relays, instrument transformers, and circuit breakers.
• To develop the understanding of students in fault analysis and protection schemes for power system equipment and networks.
• To familiarize the students with protection coordination, modeling, simulation, and testing techniques used in modern protection systems.
• To make the students learn about advanced system protection schemes and wide-area monitoring technologies for enhancing power system reliability and security.</td></tr>
<tr><td>Assessment</td><td colspan="6">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="6">60 Marks</td></tr>
<tr><td>Total</td><td colspan="6">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="6">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts, components, protection schemes, and monitoring technologies used in power system protection.	Level 1: Remember
CO2	Discuss the operation of protection systems, fault analysis methods, relay coordination, equipment protection schemes, and wide-area monitoring techniques.	Level 2: Understand
CO3	Determine appropriate protection, coordination, modeling, and testing methods for the analysis and protection of power system components and networks.	Level 3: Apply
CO4	Classify faults, protection schemes, relay characteristics, system disturbances, and monitoring approaches based on their performance and application requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction and Components of a Protection System: Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers, Generator Protection: External and internal faults – differential

protection – biased circulating current protection – self balance system – over-current and earth fault protection – protection against failure of excitation.

Unit-II

Faults and Over-Current Protection: Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection and overcurrent relay co-ordination. Transformer protection: Differential protection – self-balance system of protection – over current and earth fault protection – Buchholz' s relay and its operation..

Unit-III

Equipment Protection Schemes: Directional, Distance, Differential protection. Bus bar Protection, Bus Bar arrangement schemes.
Modeling and Simulation of Protection Schemes: CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing.

Unit-IV

System Protection: Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Suggested Readings:

1. J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York, 1987.
2. Y. G.Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.
3. A. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons, 1988.
4. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2008.
5. D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006. uggested Readings

Useful Video links

Unit No.	Topic	Link
UNIT-I	Fundamentals of Protective Relays	https://youtu.be/QsGn7H_14VY?list=PLLy_2iUCG87BIJ6ZliVIRCx2Crf9_fJMB
UNIT-II	Transformer Protection	https://youtu.be/oC5VmIGxsGA?list=PLLy_2iUCG87BIJ6ZliVIRCx2Crf9_fJMB
UNIT-III	Bus Bars Protection	https://youtu.be/utAoMJrG7vM?list=PLLy_2iUCG87BIJ6ZliVIRCx2Crf9_fJMB
UNIT- IV	Power Swing	https://youtu.be/uRCdfjVdV0w?list=PLbRMhDVUMngef3WZI2VcPeBUALq989427

Course Code	**PEC-EE-321A**				
Category	Professional Elective Courses				
Course Title	**Power Systems Stability**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • To make the students familiar with the fundamental concepts of power system stability and the factors affecting stable system operation. • To develop the understanding of students in the modelling and dynamic behavior of synchronous machines using mathematical and state-space representations. • To familiarize the students with stability assessment techniques and the role of control systems in enhancing power system performance. • To make the students learn about voltage stability, transient phenomena, sub-synchronous oscillations, and their mitigation in power systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, models, stability phenomena, and control techniques associated with power system dynamic behavior and stability.	Level 1: Remember
CO2	Discuss the principles of power system stability, synchronous machine modelling, dynamic response, voltage stability, and sub-synchronous oscillations.	Level 2: Understand
CO3	Apply stability analysis techniques and computational methods to observe the performance of power systems under different operating conditions.	Level 3: Apply
CO4	Analyze power system stability issues, machine dynamics, voltage instability conditions, and oscillatory phenomena based on their characteristics and system impact.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Power System Stability Problem: Rotor angle stability, voltage stability, short term and long-term stabilities, swing equation and its solution techniques.

Unit-II

Synchronous Machine and Its Modelling: Power transformation, flux linkage equations, voltage equation, formulation using state-space equations, normalizing voltage and torque eqns., equivalent circuit of

synchronous m/c, the flux linkage state-space model. Linearization of the flux linkage model, simplified linear model block diagram, state-space representation of simplified model.

Unit-III

Dynamic Stability: State-space representation, stability of a dynamic system, analysis of stability, Eigen properties of the state matrix, small signal stability of a single m/c infinite bus system, Effect of excitation systems, power system stabilizer, system state matrix with armature winding
Transient Stability: An elementary view of transient stability, numerical integration methods, simulation of power system dynamic response.

Unit-IV

Voltage Stability: Basic concept related to voltage stability, voltage collapse, voltage stability analysis, prevention of voltage collapse. Sub-Synchronous Oscillators: Turbine generator torsional characteristics, characteristics of series capacitor compensated transmission system, Self excitation, torsional interaction, counter measure to SSR problems, ferro resonance.

Suggested Readings

1. Power System Stability and Control by Prabha Kumar: MGH
2. Power System Control and Stability by Anderson and Fouad: Galgotia Publications
3. K. R. Padiyar, Power System Dynamics Stability and Control. Hyderabad, India: BS Publications, 2008.
4. Electrical energy theory: An Introduction by O.I. Elgerd: TMH

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to Power System Stability	https://youtu.be/70gLa0-1Rho?list=PLC3FFC85203B1EC18
UNIT-II	Modelling of Synchronous Machine	https://youtu.be/quYggqvMAw8?list=PLC3FFC85203B1EC18
UNIT-III	Numerical Integration Methods	https://youtu.be/MKlktzDjfTg?list=PLC3FFC85203B1EC18
UNIT- IV	Sub-Synchronous Oscillations	https://youtu.be/Zaw4C8S4u0s?list=PLC3FFC85203B1EC18

Course Code	**PEC-EE-323A**				
Category	Professional Elective Courses				
Course Title	**Power System Planning and Reliability**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • To make the students familiar with the principles, objectives, and methodologies of power system planning for generation, transmission, and distribution systems. • To develop the understanding of students in load and price forecasting techniques used for power system operation and expansion planning. • To familiarize the students with reliability concepts, probabilistic models, and reliability evaluation methods for power systems. • To make the students learn about reliability assessment of generation, transmission, and distribution systems for ensuring secure and economical power supply.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamentals of power system planning, load forecasting, and reliability concepts.	Level 1: Remember
CO2	Explain load forecasting techniques and reliability evaluation methods used in power systems.	Level 2: Understand
CO3	Apply reliability indices and forecasting methods for generation, transmission, and distribution systems.	Level 3: Apply
CO4	Analyze power system reliability and planning performance under different operating conditions and uncertainties.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Objectives of planning, Long and short-term planning, Planning of generation, transmission and distribution systems. Least Cost Power Planning, Integration of DSM.

Unit-II

Load Forecasting: Classification and characteristics of loads. Approaches to load forecasting. Forecasting methodology. Short-run and Long run forecasting. Energy forecasting. peak demand forecasting, total forecasting, annual and monthly peak demand forecasting. Electricity Price Forecasting.

Unit-III

Basic Reliability Concepts: General reliability function, exponential distributions, meantime to failure, Markov Chains and processes and their applications, simple series and parallel system models.

Static Generating Capacity Reliability Evaluation: Outage definitions, loss of load probability methods, loss of energy probability method. Frequency and duration methods, load forecasting uncertainty.

Unit-IV

Transmission System Reliability Evaluation: Average interruption rate method. LOLP method. The frequency and duration method. Distribution System Reliability Analysis: distribution network reliability, reliability performance.

Suggested Readings:

1. Roy Billington, 'Power System Reliability Evaluation', Gordan& Breach Scain Publishers, 1990.
2. Endrenyi, J., 'Reliability modelling in Electric Power System John Wiley, 1980.
3. Billinton Roy, Allan Ronald, 'Reliability of Power System' Plenum Press, 1996.
4. David Elmakias, 'New Computational Methods in Power System Reliability'Springer-Verlag,2008.
5. Ali Chowdhury, Don Koval, 'Power Distribution System Reliability: Practical Methods and Applications, Wiley-IEEEPress,2009.
6. Dasari, S., Electric Power System Planning, IBT Publishers (1999).
7. Pabla, A.S., Electric Power Distribution, Tata McGraw Hill (2008).
8. Sullivan, R., Power System Planning McGraw (1977)
9. Knight, U.G., Power System Engineering and Mathematics, Pergamon Press (1972).
10. McDonald, J.R., Modern Power System Planning, McGraw (2007)

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to System Planning	https://youtu.be/RyD82sdTV1M?list=PLm_MSClsnwm8Cfe2XX4pT7OZeWdtlp-TR
UNIT-II	Load Forecasting	https://youtu.be/cmv1BV5UO9Y?list=PLm_MSClsnwm8Cfe2XX4pT7OZeWdtlp-TR
UNIT-III	Reliability Concepts, terms and Definitions	https://youtu.be/eAleNjyb7is?list=PLm_MSClsnwm8Cfe2XX4pT7OZeWdtlp-TR
UNIT- IV	Distribution System Reliability	https://youtu.be/v6srsNkxqXw?list=PLqNNYrlmv01BL0vtOc8RZgnYkfM06TC3Q

Course Code	**PCC-EE-302A**				
Category	Professional Core Courses				
Course Title	**Power Systems-II**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To make the students familiar with power system network modeling and power flow analysis techniques used for system operation and planning. • To develop the understanding of students in economic operation and optimal scheduling of power generation resources. • To familiarize the students with voltage regulation, load frequency control, and automatic generation control in interconnected power systems. • To make the students learn about power system stability analysis and numerical methods used for evaluating dynamic system performance.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, models, control strategies, optimization techniques, and stability criteria used in power system operation and control.	Level 1: Remember
CO2	Discuss power flow analysis, economic operation, voltage and frequency control mechanisms, and stability phenomena in power systems.	Level 2: Understand
CO3	Apply power flow, economic dispatch, load frequency control, and stability analysis methods for the operation and assessment of power systems.	Level 3: Apply
CO4	Analyze power system operating conditions, control strategies, optimization approaches, and stability characteristics based on system performance requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Power Flow Analysis: Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations.

Unit-II

Economic Operation of Power Systems: Distribution of loads between units within a plant. Distribution of loads between plants, Transmission loss equation, Classical Economic dispatch with losses. Optimal unit commitment problems and their solutions.

Unit-III

Voltage and Load Frequency Control: Introduction to control of active and reactive power flow, control of voltage, Excitation systems. Introduction to Load Frequency Control and Automatic generation control, Single area and modelling of AGC, Concept of multi area AGC.

Unit-IV

Power System Stability: Concepts, steady state and transient stability, swing equations, equal area criterion. Solution of Swing Equation, Transient stability algorithm using modified Euler's method and fourth order RungeKutta method, – multi-machine stability analysis.

Suggested Readings:

1. H. Saadat, Power System Analysis. New York, NY, USA: McGraw-Hill, 1999.
2. O.I. Elgerd, Electric Energy Systems Theory-An Introduction, Tata McGraw-Hill Edition,2008
3. S. Sivanagaraju and G. Sreenivasan, Power System Operation and Control, 1st ed. New Delhi, India: Pearson Education India, 2009
4. D. P. Kothari and I. J. Nagrath, Modern Power System Analysis, 4th ed. New Delhi, India: Tata McGraw-Hill, 2011.
5. J. D. Glover, M. S. Sarma, and T. J. Overbye, Power System Analysis and Design, 5th ed. Stamford, CT, USA: Cengage Learning, 2012.
6. J. J. Grainger and W. D. Stevenson Jr., Power System Analysis. New York, NY, USA: McGraw-Hill, 1994.
7. M. M. E. EL-Hawary, Power System SCADA and Smart Grids. Hoboken, NJ, USA: Wiley-IEEE Press, 2014.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Classification of buses	https://www.youtube.com/watch?v=GuiDHThayS8
	Gauss Siedel Method	https://www.youtube.com/watch?v=GuiDHThayS8
	Newton-Raphson Methods	https://www.youtube.com/watch?v=m7BMdsZ7Swg
UNIT-II	Economic load dispatch	https://www.youtube.com/watch?v=JRbk0_Klhr4
	Unit commitment	https://www.youtube.com/watch?v=8n8ZNeQIldw
UNIT-III	Load Frequency Control of single area system	https://www.youtube.com/watch?v=y_r0MHv6cMU
	LFC of two area system, Area Control Error	https://www.youtube.com/watch?v=qborFmJUCv0
	Excitation systems.	https://www.youtube.com/watch?v=ZRDgn0u-rKo
UNIT-IV	Swing equation	https://www.youtube.com/watch?v=OO-bPCO-1yg&list=PL36A60B630E8C7B56&index=36
	Equal area criterion	https://www.youtube.com/watch?v=KJcxz3kl_Ik
	Multi-Machine Stability analysis	https://www.youtube.com/watch?v=yv6i9plC9nk

Course Code	**PCC-EE-304A**	
Category	Professional Core Courses	
Course Title	**Power Electronics**	
Scheme and Credits	L: 3, T: 1, P: 0, **Credits: 4**	**Semester-VI**
Course Objectives	The objectives of this course are to • To make the students familiar with the characteristics, operation, and applications of power semiconductor devices used in power electronic systems. • To develop the understanding of students in switching, triggering, protection, and commutation techniques employed in power electronic converters. • To familiarize the students with the principles and operation of controlled rectifiers and AC–DC conversion systems. • To make the students learn about DC–AC and DC–DC power conversion techniques and their performance characteristics in power electronic applications.	
Assessment	40 Marks	
End Semester Examination	60 Marks	
Total	100 Marks	
Duration of Exam	03 Hours	

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe fundamental concepts, power semiconductor devices, converter topologies, switching techniques, and control methods used in power electronics.	Level 1: Remember
CO2	Discuss the operation, characteristics, triggering methods, protection schemes, and performance of power electronic devices and converters.	Level 2: Understand
CO3	Apply the operating parameters and performance characteristics of rectifiers, converters, inverters, and choppers used in power electronic systems.	Level 3: Apply
CO4	Classify power electronic devices, converter circuits, commutation techniques, and control schemes based on their operating characteristics and application requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

INTRODUCTION: Role of power electronics, review of construction and characteristics of power diode, Schottky diode, power transistor, power MOSFET, DIAC, Triac, GTO, IGBT & SIT.

Unit-II

SCR: Construction and characteristics of SCR, Ratings and protections, series and parallel connections, R, RC and UJT firing circuit and other firing circuits based on ICs and microprocessors, pulse transformer and opto-coupler, commutation techniques.

Unit-III

THYRISTOR RECTIFIER: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

CONVERTERS: Six and Twelve pulse converters, fully and half controlled converters, continuous and discontinuous modes of operation, reactive power demand, effect of source inductance, introduction to four quadrant / dual converter, power factor improvement techniques, forced commutated converter.

Unit-IV

INVERTERS: Basic circuit, 120-degree mode and 180-degree mode conduction schemes, modified McMurray half bridge and full bridge inverters, current source inverter (CSI).

CHOPPERS: Basic scheme, output voltage control techniques, one, two, and four quadrant choppers, step up chopper, voltage commutated chopper, current commutated chopper.

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Suggested Readings:

1. P.S Bhimra, “Power Electronics”, Khanna publication.
2. MH Rashid, “Power Electronics “, PHI
3.A.K.Gupta and L.P.Singh, “Power Electronics and Introduction to Drives”,.Dhanpat Rai
4. HC Rai, “Power Electronics”, Galgotia
5. GK Dubey, “Thyristorised Power Controllers”,PHI
6. PC Sen, “Power Electronics”, TMH
7. .MH Rashid, “Handbook of power electronics “, Elsevier

Useful Video links

Unit No.	Topic	Link
UNIT-I	Construction and characteristics of power MOSFET	https://youtu.be/RyDdVd1hFkU
UNIT-II	SCR turn ON Methods in Power Electronics	https://youtu.be/u9r3YvtqPMA?list=PLgwJf8NK-2e5Hnu82T1CYLZ8kbZs4Jx8x
UNIT-III	Single phase half wave-controlled rectifier with r load	https://youtu.be/4zyTah3-P0k
UNIT-IV	Three Phase Inverter 180 Degree Conduction Mode (Working, Operation, Waveform, Operation & Modes)	https://youtu.be/L0XaK6L3p9A

Course Code	**PCC-EE-306A**				
Category	Professional Core Courses				
Course Title	**Electrical Power Generation**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with various conventional and non-conventional energy resources, their availability, utilization, and role in power generation. • To develop the understanding of students in power generation planning, energy demand-supply scenarios, and emerging trends in the power sector. • To familiarize the students with the economic aspects of power generation, load forecasting, and tariff structures used in electrical power systems. • To make the students learn about the operating principles, configurations, and applications of conventional and renewable power generation technologies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, energy resources, power generation technologies, economic parameters, and renewable energy systems used in electrical power generation.	Level 1: Remember
CO2	Discuss the principles, characteristics, economics, and operational aspects of conventional and non-conventional power generation systems.	Level 2: Understand
CO3	Apply economic and load-related parameters for the assessment and operation of power generation systems.	Level 3: Apply
CO4	Classify energy resources, power generation technologies, economic factors, and renewable energy systems based on their performance, suitability, and application requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Energy sources, their availability, classification, recent trends in Power Generation, Energy scene of supply and demand in India and the world, potential of non-conventional energy resources, Interconnected Generation of Power Plants, Present status and future trends.

Unit-II

Power Generation Economics: Economic scheduling principle, Load curves, Base load and Peak load power plants, Load forecasting, Cost of electrical energy, Tariffs, Peak load pricing, connected load, maximum demand, demand factor, Group diversity factor, significance of load factor, plant factor, capacity factor, Load forecasting, Concept of Net metering.

Unit-III

Conventional Energy Generation: General developing trends, layout and working of thermal power stations, Introduction to super thermal technology, hydroelectric plant, site selection, pumped storage power plant, mini and micro hydroelectric plants, nuclear power plants, and gas turbine power plants.

Unit-IV

Non-Conventional Methods: Fundamental of Solar power generation, PV array construction and working, Introduction to wind turbine, construction, working principle, horizontal and vertical wind turbine system. Power in the wind, Basic principle of design and different types of fuel cells and their applications, future prospects.

Suggested Readings:

1. H. P. Garg, Solar Energy: Fundamentals and Applications. New Delhi, India: McGraw-Hill, 2012.
2. S. P. Sukhatme and J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, 3rd ed. New Delhi, India: McGraw-Hill, 2008.
3. B. R. Gupta, Generation of Electrical Energy. New Delhi, India: S. Chand, 2014.
4. M. M. El-Wakil, Powerplant Technology. New York, NY, USA: McGraw-Hill, 1984.
5. B. H. Khan, Non-Conventional Energy Resources, 3rd ed. New Delhi, India: McGraw-Hill Education, 2017.
6. G. D. Rai, Non-Conventional Sources of Energy, 6th ed. New Delhi, India: Khanna Publishers, 2018.
7. K. R. Rao, Ed., *Energy and Power Generation Handbook: Established and Emerging Technologies*. New York, NY, USA: ASME Press, 2011.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Energy sources, their availability	https://www.youtube.com/playlist?list=PLD4ED2FAF3C155625
	recent trends in Power Generation, Energy scene of supply and demand in India	https://www.youtube.com/watch?v=Yg6XsepGCKY&list=PLD4ED2FAF3C155625&index=2
UNIT-II	Load curves, Base load and Peak load power plants	https://www.youtube.com/watch?v=jb28ZGAUTx8
	connected load, maximum demand, demand factor, Group diversity factor,	https://www.youtube.com/watch?v=jb28ZGAUTx8
UNIT III	working of thermal power stations	https://www.youtube.com/watch?v=45_nQN-9XSs&list=PLD4ED2FAF3C155625&index=3
	hydroelectric plant	http://youtube.com/watch?v=JBrdUoU2uTE&list=PLD4ED2FAF3C155625&index=4
UNIT-IV	Non-Conventional Sources of Energy	https://www.youtube.com/watch?v=GRwJqD4StEU&list=PLD4ED2FAF3C155625&index=5
	Solar, wind conversion systems	https://www.youtube.com/watch?v=UW4HYJ36q0Y&list=PLD4ED2FAF3C155625&index=6

Course Code	**PCC-EE-308A**				
Category	Professional Core Courses				
Course Title	**Computer Aided Electrical Machine Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with the fundamental principles, design factors, and modern practices involved in the design of electrical machines. • To develop the understanding of students in the selection of design parameters, dimensions, and performance considerations of electrical machines. • To familiarize the students with the design methodologies of transformers, induction motors, synchronous machines, and DC machines. • To make the students learn about computer-aided design techniques, performance prediction, and optimization methods applied to electrical machine design.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental principles, design factors, specifications, and constructional features of electrical machines.	Level 1: Remember
CO2	Explain the design procedures and selection criteria of specific electric and magnetic loadings, dimensions, slots, windings, and magnetic circuits of electrical machines.	Level 2: Understand
CO3	Apply design equations and standard specifications to determine the main dimensions and winding parameters of electrical machines.	Level 3: Apply
CO4	Analyze electrical machine design problems using computer-aided design techniques, optimization methods, and performance prediction approaches.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

FUNDAMENTAL ASPECTS OF ELECTRICAL MACHINE DESIGN: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.
BASIC DESIGN PRINCIPLES: Output equation and output coefficient, Specific electric and Magnetic loading. Relation between rating and main dimension of rotating machine, Effect of size and ventilation/Factors affecting size of a rotating machine.

Unit-II

DESIGN OF INDUCTION MOTORS: Three Phase Induction Motor: Standard specifications, output equations, choice of specific loadings, main dimensions, conductor size and turns, air gap length, no. of slots, slot design, stator core depth, rotor design, rotor bars& slots area, end rings.

Unit-III

DESIGN OF TRANSFORMER: Output Equations of Single Phase and Three Phase Transformers, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, Main Dimensions - kVA output for single and three phase transformers, Window space factor, Design of core, yoke and winding, overall dimensions.

DESIGN OF SYNCHRONOUS MACHINE: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding, design difference between turbo alternator & salient pole generators.

Unit-IV

DESIGN OF DC MACHINES: Output equation, choice of specific loadings, choice of poles and speed, Design of core length, armature diameter, depth of armature core, air gap length, cross section of armature conductors, armature slots, design of field system field poles, field coils, commutator.

COMPUTER AIDED DESIGN: Computerization of design Procedures. Development of Computer program and performance prediction. Optimization techniques and their applications to design Problems.

Suggested Readings:

1. A course in Electrical Machine Design by A.K. Sawhney, Khanna Pub.
2. Principles of Electrical Machine Design by R. K. Aggarwal.
3. Theory, performance and Design of alternating current machines by MG Say, ELBS, 15th Ed.1986.
4. Theory, Performance and Design of Direct Current machines by A.E. Clayton, 3rd Ed. 1967.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to Computer Design	https://youtu.be/UusLpwO7DMo?list=PLp6ek2hDcoNCOQduaaLYTBE9GqTdMbNUC
UNIT-II	Design of Induction Machine	https://youtu.be/m7P6wjAd2o4?list=PLp6ek2hDcoNCOQduaaLYTBE9GqTdMbNUC
UNIT III	Design of Transformer	https://youtu.be/65RYZSUQ41U?list=PLp6ek2hDcoNCOQduaaLYTBE9GqTdMbNUC
UNIT-IV	Design of DC Machine	https://youtu.be/zBTFqblgM8?list=PLp6ek2hDcoNCOQduaaLYTBE9GqTdMbNUC

Course code	**LC-EE-310A**				
Category	Professional Core Courses (Lab Course)				
Course title	**Power System-II Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Develop understanding of voltage and frequency control mechanisms including turbine governing systems, and excitation systems. • Develop analytical and problem-solving skills related to generation scheduling, transmission losses, and optimization methods used in power system operation.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand concepts of interconnected power system representation, power flow paths, speed governing characteristics	Level 2: Understand
CO2	Apply economic load dispatch and unit commitment techniques to optimize generation scheduling.	Level 3: Apply
CO3	Analyze power system behavior under disturbances and recommend control actions to maintain system stability and reliability	Level 4: Analyze
CO4	Evaluate real and reactive power control mechanisms, including frequency control in interconnected power systems.	Level 5: Evaluate

List of Experiments

Sr. No.	**Content**
1	Draw the flow chart and develop the computer program for the formation of the Y Bus of a generalized network.
2	Draw the flow chart and develop the computer program for the formation of the Z Bus of a generalized network.
3	To plot the swing curve and observe the stability.
4	To perform load flow analysis using Gauss Seidel method.
5	To perform load flow analysis using Newton-Raphson method.
6	To study comparison of different load flow methods
7	To develop the program for stability analysis.

8	To observe transmission losses and efficiency with variations in power for the given example.
9	Simulation study on LFC of two area interconnected power system.
10	Simulation study on voltage control in multi area interconnected power system.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Y-Bus Formation	https://srmeeevlab.github.io/PSA/3_Formation_of_Bus_admittance_Matrix_(without_mutual_coupling)/index.html
To perform load flow analysis using Gauss Seidel method.	https://srmeeevlab.github.io/PSA/4_Power_Flow_Analysis_by_Gauss_Seidel_method/index.html
To perform load flow analysis using Newton-Raphson method.	https://srmeeevlab.github.io/PSA/5_Power_Flow_Analysis_by_Newton_Raphson_method/index.html
To develop the program for stability analysis.	https://ps2-iitr.vlabs.ac.in/exp/smib-transient-stability/simulation.html
Simulation study on LFC of two area interconnected power system.	https://ps2-iitr.vlabs.ac.in/exp/load-frequency-control/

Course code	**LC-EE-312A**				
Category	Professional Core Courses (Lab Course)				
Course title	**Power Electronics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are to ● Provide practical exposure to the operation, characteristics, and applications of power semiconductor devices ● Develop hands-on skills in designing, implementing, and analyzing power electronic circuits.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the operating principles and characteristics of power semiconductor devices.	Level 2: Understand
CO2	Apply appropriate techniques to perform experiments on power electronic circuits.	Level 3: Apply
CO3	Analyze the performance of power electronic circuits under various operating conditions.	Level 4: Analyze
CO4	Evaluate the efficiency, switching behavior, and overall performance of power electronic systems and motor control	Level 5: Evaluate

List of Experiments

Sr. No.	**Content**
1	To study the performance characteristics of MOSFET.
2	To study the performance characteristics of IGBT.
3	To Study the Step-up Chopper with R Load.
4	To study the three phase half wave silicon controlled rectifier with R load an RL load.
5	To study the three phase full wave silicon controlled rectifier with R load RL load.
6	To Study of SCR Communication Technique Class A-E.
7	Speed control of small motor using Single Phase Dual Converter (Continuous and discontinuous Control).
8	Static Characteristics of Power diode & Shottky diode and to study reverse recovery of Power Diode & Shottky diode.
9	To Study the three phase voltage source inverter with 120° & 180° conduction mode.
10	Speed control of small motor using Single Phase Half wave & Full wave fully controlled Converter
11	To study of Firing Circuit based on ICs NE555, 7408 & 3140.

12	To study R, RC and UJT firing Circuit with Pulse transformer.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To study the performance characteristics of MOSFET.	https://pe2-iitd.vlabs.ac.in/exp/mosfet-switching-power/
To study the performance characteristics of IGBT.	https://pe2-iitd.vlabs.ac.in/exp/igbt-switching-power/
To Study the Step-up Chopper with R Load.	https://pe-iitr.vlabs.ac.in/exp/step-up-chopper/
To study the three phase half wave silicon controlled rectifier with R load an RL load.	https://pe-iitr.vlabs.ac.in/exp/three-half-silicon/
To study the three phase full wave silicon controlled rectifier with R load RL load.	https://pe-iitr.vlabs.ac.in/exp/three-full-silicon/
To Study the three phase voltage source inverter with 120° & 180° conduction mode.	https://pe-iitr.vlabs.ac.in/exp/three-phase-conduction/

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course code	**LC-EE-314A**				
Category	Professional Core Courses (Lab Course)				
Course title	**Computer Aided Electrical Machine Design Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Develop understanding of control mechanisms including turbine governing systems, and excitation systems. • Develop analytical and problem-solving skills related to generation scheduling, transmission losses, and optimization methods used in power system operation.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the design factors, limitations, and computer-aided design concepts used in electrical machines and transformers.	Level 2: Understand
CO2	Apply programming techniques to determine the main dimensions, stator, rotor, slot, core, and yoke design parameters of electrical machines.	Level 3: Apply
CO3	Analyze the performance of induction motors and transformers using computational methods.	Level 4: Analyze
CO4	Evaluate and optimize the design procedures of rotating electrical machines.	Level 5: Evaluate

List of Experiments

Sr. No.	**Content**
1	To study about design factors and its limitations.
2	To study about CAD of rotating electrical machine.
3	To study of computer aided design of transformer.
4	Write a program to measure the main dimension of an induction motor.
5	Write a program for stator design of an induction motor.
6	Write a program for rotor design of an induction motor.
7	Write a program to measure the losses and the efficiency of an induction motor.
8	Write a program to design the armature of a D.C. motor.
9	Write a program to measure the slot design of a synchronous machine.
10	Write a program to measure the core and yoke design of transformer.
11	Write a program to measure the losses in a transformer.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course Code	**MC-301A**				
Category	Mandatory Non Credit Courses – Audit Courses				
Course Title	**Essence of Indian Traditional Knowledge**				
Scheme and Credits	L	T	P	**Credits**	**Semester -V**
	2	0	0	-	
Course Objectives	The objectives of this course are • To make the students familiar with the fundamentals, structure, and components of the Indian Knowledge System including Vedas, Upavedas, Vedangas, and Upangas. • To develop the understanding of students regarding the relationship between modern science and the Indian Knowledge System. • To familiarize the students with the principles of yoga, holistic healthcare, and their significance in physical and mental well-being. • To make the students learn the practical relevance and applications of the Indian Knowledge System through case studies and interdisciplinary approaches.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the concepts related to the Indian Knowledge System, Vedas, Upavedas, Vedangas, Upangas, yoga, and holistic healthcare.	Level 1: Remember
CO2	Explain the structure, principles, and interdisciplinary relevance of the Indian Knowledge System in relation to modern science and healthcare practices.	Level 2: Understand
CO3	Apply the concepts of yoga, holistic healthcare, and Indian Knowledge traditions for promoting well-being and understanding their practical significance in contemporary society.	Level 3: Apply
CO4	Analyze the contributions and applications of the Indian Knowledge System in science, healthcare, education, and societal development through case studies and interdisciplinary perspectives.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Contents

- Basic Structure of Indian Knowledge System: Ashtadasha Vidya (Eighteen Branches of Knowledge in the Indian Knowledge System), Veda, Upaveda (Ayurveda, Dhanurveda, Gandharvaveda, Sthapatyaveda etc.), Vedanga (Shiksha, Kalpa, Nirukta, Vyakarana, Jyotisha, Chhanda), Upanga (Dharmashastra, Mimansa, Purana, Tarkashastra).
- Modern Science and Indian Knowledge System.
- Yoga and Holistic Healthcare.
- Case Studies.

Suggested Readings:

- Cultural Heritage of India – Course Materials by V. Sivaramakrishnan, Bharatiya Vidya Bhavan, Mumbai
- Modern Physics and Vedant by Swami Jitatmanand, Bharatiya Vidya Bhavan
- Holistic Science and Vedant by Swami Jitatmanand, Bharatiya Vidya Bhavan
- Tarkasangraha of Annam Bhatta by V. N. Jha (English Translation), International Chinmaya Foundation, Veliyanad, Ernakulam
- Yoga Sutra of Patanjali by Ramakrishna Mission, Kolkata
- Yoga-Darshanam with Vyasa Bhashya by G. N. Jha (English Translation), Edited by R. N. Jha, Vidyanidhi Prakashan, Delhi
- Science of Consciousness, Psychotherapy and Yoga Practices by R. N. Jha, Vidyanidhi Prakashan, Delhi
- Shodashang Hridayam by P. B. Sharma (English Translation)

Course Code	**PEC-EE-316A**				
Category	Professional Elective Courses				
Course Title	**Power Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with the planning, development, and resource assessment aspects of power projects and power systems. • To develop the understanding of students in project procurement, engineering practices, cost management, and maintenance strategies in the power sector. • To familiarize the students with the structure, operation, financing, and management of power utilities and power stations. • To make the students learn about risk assessment, safety regulations, environmental considerations, and regulatory frameworks governing the electricity industry.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, resources, management practices, regulatory frameworks, and safety requirements associated with power sector projects and operations.	Level 1: Remember
CO2	Discus power project planning, procurement processes, engineering practices, utility management, risk assessment, and electricity industry regulations.	Level 2: Understand
CO3	Determine appropriate project management, resource planning, cost control, maintenance, and safety practices for power sector applications.	Level 3: Apply
CO4	Analyze and classify power sector structures, project management strategies, resource utilization methods, regulatory mechanisms, and risk management approaches based on operational requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

INTRODUCTION: Power Scenario, Power Development, Planning, Power resources, Environment Power matters Plan, Pre-feasibility and feasibility studies, State relations for Power etc.

RESOURCES: Resources, Geophysical study, Seismic Considerations, Environmental Restraints, Resettlement and Rehabilitation.

Unit-II

PROCUREMENT: Contracting and Procurement, Consulting Services, Types of Contracts, Project Management, Organization and Economy Management, Organizational Planning and Time Scheduling, Project Cost Control.

ENGINEERING: Engineering & General Layout of Equipment's, Generator, Transformer and Switch Gear and Control Equipment, Construction Methods, Operation and Maintenance Principle, Maintenance organization and planning, Availability, life cycle cost & future development. Visits to sites.

Unit-III

POWER SECTOR: Power sector structure in different states, Regulatory Regime in those states, Power utilities in Haryana, Grid management, Power financing, Visit to sites.

POWER STATION: Management of Fuel, water Resource Electricity deviend scenario storage and handling, Pricing, Contract etc., Human resource management. Visit to sites.

Unit-IV

RISK & HAZARD: Introduction to risk, rules and regulation Aspects of Risk & Hazard Health & risk assessment visit to site.

ELECTRICITY INDUSTRY STRUCTURE & SAFETY REGULATIONS BILL: State and Central Power boards / Power corporations.

Suggested Readings:

1. Electricity Bill, Safety & Conservation Act
2. Arora & Dom Kundwar, A Course in Power Plant Engineering, Pub.: Dhanpat Rai Pub, 2000.
3. Jain & Bala Subranmanyam, "Power Plant Engineering", Dhanpat Rai Pub.,
4. Butter Worth, A.B. Gill, "Power Plant Performance Management", Pub: 1984.
5. P.C. Sharma, "Power Plant Engineering", Dhanpat Rai Pub.,
6. David A. Decenzo, Stephen P. Robbins, Human Resource Management. New Delhi: PHI Pvt. Ltd., 2004.
7. P.K. Nag, Power Plant Engg. N.Delhi: TMH, 2003

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction of Power scenario	https://www.youtube.com/watch?v=9qBxkyihhyg&list=PLwdnzlV3ogoVFaDTCr-N2b_TSBPEeBJdU&index=2&pp=iAQB
UNIT-II	Engineering & General Layout of Equipment's,	https://www.youtube.com/watch?v=_s0xWtOLXH8&pp=ygW5ASBQT1dFUiBTRUNUT1I6IFBvd2VyIHNlY3RvciBzdHJ1Y3R1cmUgaW4gZGlm
UNIT-III	Power sector structure in different states	https://www.youtube.com/watch?v=_s0xWtOLXH8&pp=ygW5ASBQT1dFUiBTRUNUT1I6IFBvd2VyIHNlY3RvciBzdHJ1Y3R1cmUgaW4gZGlm
UNIT-IV	State and Central Power boards	https://www.youtube.com/watch?v=Oiyh7J1pDgg&list=PLP0yMcMjdG7WrDGnr1EsLT1os6JvxPuGw

Course Code	**PEC-EE-318A**				
Category	Professional Elective Courses				
Course Title	**Renewable Energy Converters**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • Understand the operation, control, and performance of power electronic converters used in renewable energy systems. • Develop knowledge of converter topologies, modulation techniques, and grid integration of solar, fuel cell, and wind energy systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, converter topologies, modulation techniques, control methods, and renewable energy interfaces used in power electronic conversion systems.	Level 1: Remember
CO2	Discuss the operation, performance characteristics, harmonic behavior, and control strategies of power converters used in renewable energy systems.	Level 2: Understand
CO3	Calculate the operating parameters and performance characteristics of power converters for solar photovoltaic, fuel cell, and wind energy applications.	Level 3: Apply
CO4	Analyze power converter configurations, modulation techniques, harmonic characteristics, and grid integration methods based on system requirements and performance criteria.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction Review of 2-pulse and 6-pulse converters and their performance with inductive and capacitive loads. Harmonic analysis of single-phase and three-phase converters.

Unit-II

Power Converters for Solar PV Systems, Multi-level converters, topologies and control techniques, PWM Techniques.

Unit-III

Power Converters for Fuel Cells, Buck converter, Boost converter, interleaved buck/boost converter, advanced Modulation techniques.

Unit –IV

Power Converters in WECS Multi-channel interleaved boost converters, voltage source converters, control of grid-tied Converters, matrix converter, and modular multi-level inverters.

Suggested Readings:

1. V. Yaramasu and B. Wu, "Model Predictive Control of Wind Energy Conversion Systems," Wiley- IEEE Press, 2016.
2. Rashid M. H., “Power Electronics Circuits Devices and Applications”, 3rd Ed., Pearson Education, 2008.
3. Lander Cyril W., “Power Electronics”, Prentice Hall of India Private Limited, 2004.
4. Mohan N., Undeland T.M. and Robbins W.P., “Power Electronics-Converters, Applications and Design”, 3rd Ed., Wiley India, 2008.
5. Paice D. A., “Power Electronic Converter Harmonics – Multipulse Methods for Clean Power”, IEEE press, 1995.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Review of 2-pulse and 6-pulse converters	https://www.youtube.com/watch?v=OxIQhyAn9JE&list=PLbMVogVj5nJQoZqyLxx-cg_dYEDt2UMH&index=2&pp=iAQB
UNIT-II	Power Converters for Solar PV Systems	https://www.youtube.com/watch?v=khzMZ8VL8Q4&list=PLRQCRCvsI8vfilPpiIbsLz3NB-gTMLG8f
UNIT-III	Power Converters for Fuel Cells	https://www.youtube.com/watch?v=Q7cTuZIH8IA&list=PLgwJf8NK-2e6tDV4SbRn6RzOPNXjqODo2
UNIT-IV	Power Converters in WECS Multi-channel	https://www.youtube.com/watch?v=VA0gkl1C7qw&list=PLp6ek2hDcoNAZzkG0zfABMmFNtGUl9QMB

Course Code	**PEC-EE-320A**				
Category	Professional Elective Courses				
Course Title	**Advanced Control Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with controller configurations, compensation techniques, and their role in control system performance improvement. • To develop the understanding of students in state-space modeling and representation of dynamic systems. • To familiarize the students with state feedback design, controllability, observability, and sampled-data control systems. • To make the students learn about nonlinear system characteristics and methods for stability analysis of nonlinear control systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, controller types, compensation techniques, state-space representations, sampled-data systems, and nonlinear system characteristics used in advanced control systems.	Level 1: Remember
CO2	Discuss the principles of controller design, state-space analysis, sampled-data control, and nonlinear system behavior.	Level 2: Understand
CO3	Determine controller design, state-space modeling, pole placement, and stability analysis techniques for control system applications.	Level 3: Apply
CO4	Analyze control system configurations, state-space models, sampled-data systems, and nonlinear characteristics based on stability and performance requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Types of controllers- Feedforward-feedback-cascade-Proportional, Proportional -Integral and PID controllers.

Compensator design: Compensator design: Realization of Compensators – lag, lead and lag-lead -Design of compensator using bode plot.

Unit-II

State space analysis of systems: Introduction to state concept - state equation of linear continuous time systems, matrix representation of state equations. Phase variable and canonical forms of state representation-controllable, observable, and diagonal and Jordan canonical forms- solution of time invariant autonomous systems.

Unit-III

State feedback controller design: Controllability & observability. State feed-back design via pole placement Technique. Sampled data control system: Pulse Transfer function-Stability of sampled data system –Routh Hurwitz criterion. Introduction to state-space representation of sampled data systems.

Unit –IV

Nonlinear systems: Introduction - characteristics of nonlinear systems. Types of nonlinearities. Analysis through harmonic linearization - Determination of describing function of nonlinearities (relay, dead zone and saturation only) - application of describing function for stability analysis of autonomous system with single nonlinearity.

Suggested Readings:

1. Hassan K Khalil, Nonlinear Systems, Prentice - Hall International (UK), 2002.
2. Kuo B.C, Analysis and Synthesis of Sampled Data Systems, Prentice Hall Publications.
3. Nagarath I. J. and Gopal M., Control System Engineering, Wiley Eastern, 2008.
4. Nise N. S., Control Systems Engineering, 6/e, Wiley Eastern, 2010.
5. Ogata K., Modern Control Engineering, Prentice Hall of India, New Delhi, 2010
6. Alberto Isidori, Nonlinear Control Systems, Springer Verlag, 1995.
7. Gibson J. E., F.B. Tuteur and J. R. Ragazzini, Control System Components, Tata McGraw Hill, 2013
8. Gopal M., Control Systems Principles and Design, Tata McGraw Hill, 2008.
9. Jean-Jacques E. Slotine&Weiping Li, Applied Nonlinear Control, Prentice-Hall., NJ, 1991. C

Useful Video links

Unit No.	Topic	Link
UNIT-I	Types of Controllers	https://www.youtube.com/watch?v=39Ggoj2fQ2c&list=PLxn52v8fxX5l5tGzU1NAxRDkgqxK0k5UZ
UNIT-II	State space analysis of systems	https://www.youtube.com/watch?v=t_k7oRICmWo&pp=ugUHEgVlbi1VUw%3D%3D
UNIT-III	State feedback controller design	https://www.youtube.com/watch?v=OodHgOY5Rjs&pp=ygUpIFN0YXRlIGZlZWRiYWNrIGNvbnRyb2xsZXIgZGVzaWduOiAgbnB0ZWw%3D
UNIT-IV	Linearization of nonlinear systems.	https://www.youtube.com/watch?v=ozq9Qs75JQ0&pp=ygU0ICAgbnB0ZWxjaGFyYWN0ZXJpc3RpY3Mgb2Ygbm9ubGluZWFyIHN5c3RlbXMuICBucHRlbA%3D%3D

Course Code	**PEC-EE-322A**				
Category	Professional Elective Courses				
Course Title	**Power Quality and FACTS Controller**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • To make the students familiar with power quality issues, reactive power compensation techniques. • To develop the understanding of students in the operating principles, configurations, and control strategies of FACTS devices. • To familiarize the students with voltage source converter-based controllers and their applications in power flow control. • To make the students learn about power quality improvement techniques and the use of custom power devices in distribution systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, compensation techniques, FACTS devices, power quality disturbances, and custom power devices used in modern power systems.	Level 1: Remember
CO2	Discuss the principles, operating characteristics, control strategies, and applications of FACTS and power quality improvement devices in transmission and distribution systems.	Level 2: Understand
CO3	Apply and determine reactive power compensation, voltage control, power flow control, and power quality enhancement techniques using FACTS and custom power devices.	Level 3: Apply
CO4	Analyze and classify transmission and distribution system performance, power quality issues, compensation methods, and FACTS-based solutions based on system requirements and operational characteristics.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Transmission Lines and Series/Shunt Reactive Power Compensation: Introduction to power quality and their issues, Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

Thyristor-based Flexible AC Transmission Controllers (FACTS): Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

Unit-II

Voltage Source Converter based (FACTS) controllers: Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation.

STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.

Unit-III

Application of FACTS: Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.

Power Quality Problems in Distribution Systems: Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve.

Unit –IV

DSTATCOM: Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM.

Dynamic Voltage Restorer and Unified Power Quality Conditioner: Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering. Unified Power Quality Conditioner (UPQC): Working Principle. Capabilities and Control Strategies.

Suggested Readings:

1. N. G. Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of FACTS Systems”, Wiley-IEEE Press, 1999.
2. K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd. 2007.
3. T. J. E. Miller, “Reactive Power Control in Electric Systems”, John Wiley and Sons, New
4. York, 1983. 4. R. C. Dugan, “Electrical Power Systems Quality”, McGraw Hill Education, 2012.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to power quality	https://www.youtube.com/watch?v=19eIVIVBrfE&list=PLp6ek2hDcoNBczPs_OoWYh4Siixdm20wQ
UNIT-II	Voltage Source Converters	https://www.youtube.com/watch?v=jsj0Vg8CTtE&pp=ygUiICAgVm9sdGFnZSBTb3VyY2UgQ29udmVydGVycyBucHRlbA%3D%3D
UNIT-III	Application of FACTS devices for power-flow control	https://www.youtube.com/watch?v=Ge3yPLoGb6E&list=PLLy_2iUCG87AVyRAN4QwVQrC8vSg1vWa6&index=4&pp=iAQB
UNIT-IV	Reactive Power Compensation	https://www.youtube.com/watch?v=L5orDG9TJQg&pp=ygU5cmVhY3RpdmUgcG93ZXIgY29tcGVuc2F0aW9uIGluIHRyYW5zbWlzc2lvbiBzeXN0ZW1zIG5wdGVs

Annexure AC/5.24

~~ANNEXURE-4.4~~

Course Code	**OEC-05A**				
Category	Open Elective Courses				
Course Title	**Renewable Energy Resources**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • Introduce the fundamentals, sources, and significance of renewable and green energy systems. • Develop understanding of solar, wind, biomass, tidal, and hydrogen energy conversion technologies. • Analyze the applications, performance, and sustainability aspects of renewable energy systems for modern energy needs.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the principles, sources, and importance of renewable and green energy systems.	Level 1: Remember
CO2	Explain the working and components of solar, wind, biomass, tidal, and hydrogen energy systems.	Level 2: Understand
CO3	Apply renewable energy concepts for solar radiation, wind power, biomass conversion, and hydrogen energy applications.	Level 3: Apply
CO4	Analyze the performance, benefits, and limitations of different renewable energy technologies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE).

Unit-II

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements, Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system.
Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind;

Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and muliblade system. Vertical axis- Savonius and darrieus types.

Unit-III

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft).
Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations.

Unit –IV

Green Energy: Introduction, Fuel cells: Classification of fuel cells – H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.

Suggested Readings:

1. Renewable Energy Sources and Emerging Technologies : D.P Kothari, K.C.Singla, Rakesh Ranjan- PHI Publications, 'Latest Edition'.
2. Electric Power Generation, B.R.Gupta, 'Latest Edition'.
3. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley & Sons, Latest Edition.
4. A Course in Electric Power System, Soni, Gupta, Bhatnagar, Dhanpat Rai & Sons, Latest Edition
5. Power System Engineering, Nagrath & Kothari, Tata Mc-Graw Hill, New Delhi, 'Latest Edition'.
6. Power Plant Engg: G.D. Rai, 'Latest Edition'.
7. Electric Power: S.L. Uppal (Khanna Publishing), 'Latest Edition'.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to Renewable Energy Engineering	https://youtu.be/mh51mAUexK4?list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk
UNIT-II	Solar Radiation	https://youtu.be/Og4LEc7SpdQ?list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk
UNIT-III	Classification of Bio gas plants	https://youtu.be/TUu40kDqcEc?list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk
UNIT-IV	Fuel Cells	https://youtu.be/L2VSOccUrSk

Annexure AC/5.25

~~ANNEXURE 4.5~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations

(Under NEP-2020)

B-SCHEME

Common for Bachelor of Technology Electrical Engineering

And

Bachelor of Technology Electrical Engineering-Working Professionals

Effective from

Academic Session 2026-27 (From 2nd Year onwards)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

5. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	1 Practical (P) per week	0.5 Credit
4	2 Practical (Lab) per week	1 Credit

6. RANGE OF CREDIT

A range of credits from 160 to 170 for a student to be eligible to get Under Graduate degree in Electrical Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

7. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Basic Science Courses	21
2	Engineering Science Courses	22
3	Professional Core Courses	71
4	Professional Elective Courses (Relevant to chosen specialization/branch)	12
5	Open Electives Courses	9
6	Humanities and Social Sciences including Management courses	12
7	Project work, seminar and internship in industry or appropriate work place/ academic and research institutions in India/abroad	20
8	Value Added Courses	03
9	Mandatory Non Credit Courses – Audit Course	(Non-Credit)
	Total Credits	**170**

8. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Basic Science Courses	BSC
2	Engineering Science Courses	ESC
3	Professional Core Courses	PCC
4	Professional Elective Courses (Relevant to chosen specialization/branch)	PEC
5	Indian Knowledge System	IKS
6	Multidisciplinary Open Electives Courses	OEC
7	Humanities and Social Sciences including Management courses	HSMC
8	Laboratory Courses	LC
9	Mandatory Non-Credit Courses (Audit Course)	MC
10	Project	PR
11	Internship/ Practical Training/ Seminar	INT

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

Common for B.Tech (Electrical Engineering) – 3rd Semester

and

B.Tech (Electrical Engineering-Working Professionals) – 3rd Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Humanities and Social Sciences including Management courses	HSMC-02B	Economics for Engineers	3	0	0	3	3	30	45		75	3
2	Professional Core Courses	PCC-EE-201B	Analog Electronics	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	PCC-EE-203B	Electric Circuit Analysis	3	1	0	4	4	40	60		100	3
4	Professional Core Courses	PCC-EE-205B	Measurement and Instrumentation	3	0	0	3	3	30	45		75	3
5	Professional Core Courses	PCC-EE-207B	Electrical Machines-I	3	0	0	3	3	30	45		75	3
6	Professional Core Courses	PCC-EE-209B	Electrical Engineering Materials	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-EE-211B	Analog Electronics Lab	0	0	2	2	1	10		15	25	3
8	Professional Core Courses	LC-EE-213B	Electric Circuit Analysis Lab	0	0	2	2	1	10		15	25	3
9	Engineering Science Courses	LC-EE-215B	Measurement and Instrumentation Lab	0	0	2	2	1	10		15	25	3
10	Professional Core Courses	LC-EE-217B	Electrical Machines-I Lab	0	0	2	2	1	10		15	25	3
Total Credits								**23**				**575**	

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

Common for B.Tech (Electrical Engineering) – 4th Semester

and

B.Tech (Electrical Engineering-Working Professionals) – 4th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Basic Science Course	BSC-MEE-202B	Engineering Mathematics-III	3	1	0	4	4	40	60		100	3
2	Professional Core Course	PCC-EE-204B	Electrical Machines-II	3	0	0	3	3	30	45		75	3
3	Professional Core Course	PCC-EE-206B	Digital Electronics	3	0	0	3	3	30	45		75	3
4	Professional Core Course	PCC-EE-208B	Power Systems-I	3	0	0	3	3	30	45		75	3
5	Engineering Science Course	PCC-CSE-207B	Python Programming (Common with CSE 3rd Sem)	3	0	0	3	3	30	45		75	3
6	Professional Elective Course	Refer Table-I	Professional Elective-I	3	0	0	3	3	30	45		75	3
7	Professional Core Course	LC-EE-210B	Electrical Machines-II Lab	0	0	2	2	1	10		15	25	3
8	Professional Core Course	LC-EE-212B	Digital Electronics Lab	0	0	2	2	1	10		15	25	3
9	Professional Core Course	LC-EE-214B	Power Systems-I Lab	0	0	2	2	1	10		15	25	3
10	Engineering Science Course	LC-CSE-213B	Python Programming Lab	0	0	2	2	1	10		15	25	3
11	Mandatory Courses	MC-201B	Environmental Science	2	0	0	2	0	20	30		50*	3
Total Credits								**23**				**575**	

Notes:

I. Note-1: MC-201B is a mandatory non–credit course in which students will be required to obtain passing marks in theory. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in detailed marks certificate of student.

II. At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester. For students who didn't attend practical training: If you didn't attend practical training, discuss with your Coordinator/Head of Department to explore options and create a plan to complete the requirement. Students who miss practical training due to personal or technical reasons can pursue it during session timings after classroom hours with the Head of Department's permission. The student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre/Project/Seminar report, etc.

III. The students under working professionals must obtain training certificate preferably from the company in which currently working.

IV. Students should take Massive Open Online Courses (MOOCs) approved by the concerned Chairperson Board of Studies (BoS)

V. Choose any one from Professional Elective-I

Table 1 Professional Elective – I

Sr. No.	Code	Subject
1	PEC-EE-216B	Wind and Solar Energy Systems
2	PEC-EE-218B	Electromagnetic Field Theory
3	PEC-EE-220B	Special Electrical Machines
4	PEC-EE-222B	High Voltage Engineering

*A student can do only one course from MOOC in leu of elective courses in a semester with a approval of Head of the Department.

Course Code	**HSMC-02B**				
Category	Humanities and Social Sciences including Management Courses				
Course Title	**Economics for Engineers**				
Scheme and Credits	L	T	P	**Credits**	**Semester- III**
	3	0	0	3	
Course Objectives	The objectives of this course are to • Introduce the basic concepts of economics and their relevance to science, engineering, and national development. • Develop a foundational understanding of microeconomic principles such as demand, supply, production, cost, and market structures. • Equip students with tools to apply economic reasoning to real-world pricing, output, and market decisions. • Familiarize students with macroeconomic elements like the Indian economy, banking system, privatization, and globalization.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe economic concepts, the connection between economics and engineering and technological development, along with economic laws relevant to resource-based decision making in society.	Level 1: Remember
CO2	Explain economic growth theories and illustrate the role of engineering and technology in supporting economic development.	Level 2: Understand
CO3	Apply theories of consumption and production to the design and development of engineering products.	Level 3: Apply
CO4	Analyze market conditions, evaluate cost structures and financial aspects to assess the feasibility of engineering projects.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Definition of Economics: Various Definitions, Types of Economics, Micro and Macro Economics, Nature of Economic Problem, Production Possibility Curve, Economic Laws and their Nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand: Meaning of Demand, Law of Demand, Elasticity of Demand, Meaning, Factors affecting the Elasticity of Demand, Practical Application and Importance.

Unit-II

Production: Meaning of Production and Factors of production, Law of Variable Proportions, Returns to Scale, Internal and External Economies and Diseconomies of Scale, Various concepts of Cost of Production- Fixed Cost, Variable Cost, Money Cost, Real Cost, Accounting Cost, Marginal Cost, Opportunity Cost, Shape of Average Cost, Marginal Cost, Total Cost etc. in short run and long run.

Unit-III

Market: Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).
Supply: Supply and Law of Supply, Role of Demand and Supply in Price Determination and Effect of Changes in Demand and Supply on Prices.

Unit-IV

Indian Economy: Nature and Characteristics of Indian Economy as underdeveloped, developing and mixed economy (brief and elementary introduction).
Privatization: Meaning, Merits and Demerits.
Globalization of the Indian Economy: Merits and Demerits
Banking: Concept of a Bank, Commercial Bank, Central Bank, Functions of a Bank, Difference between Commercial and Central Bank.

Suggested Readings:

- Modern Microeconomics: Theory and Applications by H.L. Ahuja, S. Chand & Company Pvt. Ltd.
- Indian Economy by S.K. Misra & V.K. Puri, Himalaya Publishing House.
- Indian Economy: Principles and Policies by Sri Rangam, Sri Ram, & Rohit Deo, Pearson Education.
- Managerial Economics by R. Cauvery, S. Chand & Company Pvt. Ltd.
- Microeconomic Theory by Andreu, Whinston, D. Michael, Green, R. Jerry, Oxford University Press.
- Principles of Economics by E. Karl, C. Ray, Oster, & E. Sharon, Pearson Education.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Fundamental concepts of microeconomics, including definitions, types, and the nature of economic problems.	https://www.youtube.com/watch?v=IFtOcNbej0o&list=PLFNFJbo2hfBGRTCMuroZGykNzacwmAH2L
Unit-II	Production and Cost of production	https://www.youtube.com/watch?v=VU1zySe-8NA
Unit-III	Theory of Markets	https://www.youtube.com/watch?v=HylqSa58lqQ
Unit-IV	Nature and characteristics of the Indian economy, highlighting aspects of underdevelopment and development.	https://www.youtube.com/watch?v=ME-0GOhhZcs&list=PLFW6lRTa1g83winAoIK92HL4xTytJaW7S

Course Code	**PCC-EE-201B**				
Category	Professional Core Courses				
Course Title	**Analog Electronics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To understand response of BJT and MOSFET. • To develop the ability to design and implement OP-AMP-based applications. • To design oscillator and power amplifier circuits. • To impart knowledge of feedback principles and feedback topologies				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Remember the fundamentals and characteristics of semiconductor devices and analog electronic circuits.	Level 1: Remember
CO2	Understand the principles and operation of amplifiers, feedback circuits, and operational amplifiers.	Level 2: Understand
CO3	Apply the concepts of analog electronics to basic circuit analysis and electronic applications.	Level 3: Apply
CO4	Analyze the performance and behavior of analog electronic circuits and systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Semiconductor Devices: P-N Junction Diode: I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits, Special Purpose Diodes: LED, Photodiode, Varactor diode, Schottky diode.

Bipolar Junction Transistors (BJT): Structure and characteristics, Common base, common collector and common emitter configuration, BJT as Switch, BJT as an amplifier, RC Coupled amplifier: Frequency response curve, Bandwidth.
MOSFET: Structure and I-V characteristics, MOSFET as a switch, MOSFET as amplifier.

Unit-II

Feedback: Concept of Feedback, Negative Feedback and Positive feedback, properties of negative feedback, Advantages and Disadvantages of Negative Feedback, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, and the shunt-shunt and shunt series feedback amplifier.

Power Amplifier: Definition, Application & Types of Power Amplifiers (Class A, B, C, & D), Push Pull Amplifiers, Distortion & Efficiency of Power Amplifier, Integrated Circuit Power Amplifier.

Unit-III

Operational Amplifier Fundamentals: Block Diagram Representation, Ideal OP-AMP, OP-AMP Equivalent Circuit, Characteristics of OP-AMP, Characteristics of Ideal OP-AMP, Ideal Voltage Transfer Curve, Input Offset Voltage, Input Bias Current, Input Offset Current, Output Offset Voltage, Thermal Drift, Effect of Variation in Power Supply Voltages on Offset Voltage, Common Mode Configuration and CMRR, Frequency Response of OP-AMP: Open Loop Response, Close Loop Response, Input and Output Impedances, Effect of Finite Gain Bandwidth Product, Slew Rate, OP-AMP as Integrator & Differentiator.

Unit-IV

Operational Amplifier Applications: Linear and non-linear applications- Instrumentation Amplifier, voltage regulator, Active Filters, ADC and DAC, Square wave and triangular wave generator, Multivibrators.

Oscillators: Introduction, Barkhausen Criterion, Conditions for Sustained Oscillations & Frequency of Oscillations, Oscillator with RC Feedback circuit (RC Phase Shift, Wien Bridge), Tuned Collector, LC Feedback circuits (Hartley, Colpitts), Crystal Oscillator.

Suggested Readings:

- Integrated Electronics by Millman Halkias, TMH.
- Electronics Device & Circuit by Robert Boylestad, & Louis Nashelsky, Pearson Education.
- Electronics Device & Circuit Theory by I.J. Nagrath, PHI Learning.
- Electronics Device & Integrated Circuit by A.K. Singh, PHI Learning.
- A Textbook of Electronic Devices and Circuits by J.B. Gupta, S.K. Kataria and Sons.
- Integrated Electronics: Analog and Digital Circuits and Systems by Millman, Jacob, TMH.
- Applications and Design with Analog Integrated Circuits by Jacob, Michael, Pearson Education.

Useful Video Links

Unit No.	Topics	Links
Unit-I	RC Coupled Amplifiers	https://youtu.be/BSR26SU3R2U
Unit-II	Power Amplifiers	https://youtu.be/huDZjQcEBMg
Unit-III	Voltage regulators	https://youtu.be/R_QnIAEk7Go
Unit-IV	Operational Amplifier	https://youtu.be/clTA0pONnMs

Course Code	**PCC-EE-203B**				
Category	Professional Core Courses				
Course Title	**Electric Circuit Analysis**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To make the students familiar with the fundamental principles and analysis techniques of electrical circuits using network theorems and circuit laws. • To develop the understanding of students in the transient and steady-state behavior of electrical circuits under various excitation conditions. • To familiarize the students with AC circuit analysis, resonance phenomena, and transform-based methods for circuit evaluation. • To make the students learn about passive network synthesis and two-port network representations for electrical network analysis and design.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, circuit laws, network theorems, transient and steady-state parameters, synthesis methods, and two-port network representations used in electrical circuit analysis	Level 1: Remember
CO2	Discuss the behavior of electrical circuits under transient and steady-state conditions, network synthesis techniques, and two-port network characteristics.	Level 2: Understand
CO3	Determine circuit parameters, network responses, resonance conditions, transform-based solutions, and two-port network characteristics for electrical circuits.	Level 3: Apply
CO4	Classify electrical networks, transient and steady-state responses, synthesized networks, and two-port network configurations based on their characteristics and performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each Unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Network Theorems in AC Circuit: Circuit elements, KCL, KVL, Nodal and mesh Analysis, Independent and dependent sources, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem.

Unit-II

Transient State Analysis: Forced and free response, Time constants, Transient behavior of circuit elements under switching conditions and their representations, Solution of first and second-order

circuits, Evaluations of initial and final states in series and parallel RL, RC and RLC circuits with AC and DC excitation.

Unit-III

Steady State Analysis: Sinusoidal response of series and parallel RL, RC and RLC circuits, Power in AC circuits, Three-phase circuits, Resonance, Laplace Transform and its application in circuit analysis.

Unit-IV

Synthesis of passive networks: Hurwitz polynomials, Positive real functions, Concept of Network Synthesis, RL, RC & LC network synthesis, Network graphs.
Two Port Network: Impedance parameter, Admittance parameter, Transmission parameter, Hybrid parameter, Inverse hybrid parameter, Inverse transmission parameter, Relationship between parameter sets, Interconnection of two-port networks.

Suggested Readings

- Fundamentals of electric circuits by Alexander, K. Charles, & Matthew Sadiku, McGraw Hill Education.
- Network Analysis by M E. Van-Valkenburg, Prentice Hall.
- Circuits and Networks by A Sudhakar, Tata McGraw-Hill.
- Engineering Circuit Analysis by W. Hayt, Tata McGraw-Hill.
- Electric Circuit by D.A. Bell, Oxford University press.
- Introduction to Modern Network Synthesis by M E. Van-Valkenburg, Wiley and Sons.
- Introduction to Modern Network Synthesis by Suresh Kumar, Dorling Kindsley.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Basic Circuit Elements	https://youtu.be/zkWvL1pPkMY
	Mesh and Nodal Analysis	https://youtu.be/TBmX3d8zuXU
	Network Theorems	https://youtu.be/LPttepJwgNE
Unit-II	Transient State Analysis	https://youtu.be/jT7R1Ez6Vg?list=PLbRMhDVUMngfNnABo5mre45ZbHqJE2sUn
	First and Second Order Circuits	https://youtu.be/alkm4B9JPWw
	Laplace transformation and its application	https://youtu.be/uJujJlkro6s
Unit-III	Sinusoidal steady state Analysis	https://youtu.be/c6U3Vnq6IL4
	Active and Reactive power in A.C circuit	https://youtu.be/4SnFYwxsr8M
Unit-IV	Graph Theory	https://youtu.be/0BQ2yyC6Lc8?list=PLbRMhDVUMngfNnABo5mre45ZbHqJE2sUn
	Two port networks	https://youtu.be/geM6Qz61MBA

Course Code	**PCC-EE–205B**				
Category	Professional Core Courses				
Course Title	**Measurement and Instrumentation**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with the fundamental principles, characteristics, and standards of electrical measurements and measuring instruments. • To develop the understanding of students in measurement errors, instrument performance, and techniques for accurate electrical measurements. • To familiarize the students with analog and digital measuring instruments, transducers, and display devices used in electrical engineering applications. • To make the students learn about bridge methods and measurement techniques for determining electrical parameters and resistances with high accuracy.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, characteristics, errors, measuring instruments, transducers, and bridge circuits used in electrical measurements.	Level 1: Remember
CO2	Explain the operating principles, performance characteristics, error sources, and measurement techniques of electrical measuring instruments and systems.	Level 2: Understand
CO3	Determine electrical quantities, instrument parameters, bridge balance conditions, and measurement results using appropriate measurement techniques.	Level 3: Apply
CO4	Classify measuring instruments, transducers, measurement errors, and bridge circuits based on their characteristics, accuracy, and application requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Introduction: Introduction to measurement, Methods of measurement, Classification of instruments, Types of errors in measurement. Accuracy, tolerance, sensitivity, reproducibility, absolute and secondary measuring instruments, recording instruments. CRO.

Unit-II

Analog Instruments: Classifications of analog instruments, Introduction to operating, controlling and damping torque, Electrodynamometer type wattmeter, Electro-dynamometer type Power factor meter. Moving Coil

(PMMC) & Moving Iron (MI) instruments: construction, torque equation range extension, effect of temperature, classification, errors, advantages, and disadvantages.

Unit-III

AC-DC Bridges and Potentiometer: AC-DC Bridges: Measurement of resistance: Wheatstone, Kelvins Double, and Megger, earth resistance measurement by earth tester Measurement of inductance and capacitance: Maxwell's bridge, Schering bridge, Potentiometer, Numerical problem

Unit-IV

Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Instrument Transformer: Current Transformer (CT), Types of CT (measuring and protection), Potential Transformer (PT). Introduction to Transducers and their Application

Suggested Readings:

- A course in Electrical and Electronic Measurements and Instrumentation by A. K. Sawhney, & Puneet Sawhney, Dhanpat Rai & Company.
- LabVIEW graphical programming by Jennings, Richard, & Fabiola De La Cueva, McGraw-Hill Education.
- Electronic Instrumentation and Measurements by A. David Bell, Oxford University Press.
- Electrical Measurements and Measuring Instruments by E. W. Golding, F. C. Widdis, 6th Edition, Medtech.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Sources of Errors in measurements	https://www.jove.com/v/14506/types-of-errors-detection-and-minimization
	Loading effects of instruments	https://www.electricalengineering.xyz/loading-effect-of-electrical-measurement-instruments/
Unit-II	Single phase energy meter	https://emimnit.wordpress.com/2016/10/16/single-phase-energy-meter/?utm_source=chatgpt.com
	Introduction of virtual instruments	https://www.youtube.com/watch?v=iGYOlnOP6vw
Unit-III	Comparison of analog & digital techniques	https://www.youtube.com/watch?v=rkOWP9oVaXk
	Oscilloscope & its application	https://www.tek.com/en/documents/primer/oscilloscope-basics?utm_source=chatgpt.com
Unit-IV	Limitation of Wheatstone bridge	https://www.shiksha.com/online-courses/articles/learning-wheatstone-bridge-principle/?utm_source=chatgpt.com
	General balance equation , CKT diagram, phasor diagram	https://www.electrical4u.com/wheatstone-bridge-circuit-theory-and-principle/

Course Code	**PCC-EE-207B**				
Category	Professional Core Courses				
Course Title	**Electrical Machines-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with the principles of electromagnetic induction, magnetic circuits, and the constructional features of electrical machines. • To develop the understanding of students in the operation, characteristics, testing, and performance of DC machines. • To familiarize the students with the construction, operation, equivalent circuits, testing, and performance evaluation of transformers. • To make the students learn about three-phase transformers, special transformer connections, parallel operation, and transformer performance enhancement techniques.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concept of magnetic circuits, constructional features, operating principles, characteristics, and testing methods of DC machines and transformers.	Level 1: Remember
CO2	Discuss the general laws and rules of electromagnetic induction, operation, performance characteristics, losses, testing procedures, and transformer connections used in electrical machines.	Level 2: Understand
CO3	Calculate machine and transformer parameters, performance characteristics, efficiency, voltage regulation, and operating conditions using appropriate methods.	Level 3: Apply
CO4	Analyze DC machine characteristics, transformer configurations, operating performance, testing results, and connection schemes based on application requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

General introduction to electrical machines: Magnetic circuits, Concepts of reluctance and permeance, Faraday's law of electromagnetic induction, Lenz's Law and Fleming's rules. Electromechanical energy conversion principle, Principle of operation of generators and motors. Magnetic curves and their relevance.

Unit-II

D.C Machines: Constructional features, armature windings - simple lap and wave winding; armature voltage and torque equations. D.C generators: Classifications, performance characteristics; Losses, efficiency and power flow diagram.
D.C. motors: Classifications, torque/speed characteristics of different types; Losses, efficiency and power flow diagram. Starting, speed control and braking. Testing and efficiency. BLDC motor

Unit-III

Transformers: Constructional features; Ideal transformer and practical transformer, name plate rating, phasor diagrams, equivalent circuit and determination of its parameters from O.C and S.C tests, sunneber test and other test; referred values of Input and output side; Regulation, efficiency and all-day efficiency expressions and calculations. Parallel operation.

Unit-IV

Autotransformer: Basic constructional features; Comparative study with two winding transformers. 3-phase Transformer: As a single unit with name plate rating and as a bank of three single phase transformers; Parallel operation conditions and load sharing.

Suggested Readings:

- Electric Machinery by A. E. Fitzgerald and C. Kingsley, McGraw Hill Education.
- Performance and design of DC machines by A. E. Clayton and N. N. Hancock, CBS Publishers.
- Performance and design of AC machines by M. G. Say, CBS Publishers.
- Electrical Machinery by P. S. Bimbhra, Khanna Publishers.
- Electric Machines by I. J. Nagrath and D. P. Kothari, McGraw Hill Education.
- Electric Machines by Ashfaq Husain and Haroon Ashfaq, Dhanpat Rai & Co.
- A Text Book of Electrical Technology by B.L. Theraja & A.K. Theraja, S.Chand.
- DC Machines and Transformers by Deshveer Narwal, M. Balasubbareddy, Atul Katiyar, & Nitish Kumar, SIPH.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Principle of Rotating Electrical Machines	https://youtu.be/Rd5q7a7IXvs
	Pitch factor and Winding Factor	https://youtu.be/cyl9uLt4swo
Unit-II	Introduction to DC Machine	https://youtu.be/PRdLNTQ2fRE
	Armature Winding	https://youtu.be/GdwG6Padf2M
Unit-III	Starting of DC Motor	https://youtu.be/DgQE286XwHw
	Speed Control of DC Shunt Motor	https://youtu.be/J3EUw7J16c8
Unit-IV	Short Circuit Test	https://youtu.be/puQ7lzZJ_3s
	Voltage Regulation	https://youtu.be/NnBbKE7VHRQ

Course code	**PCC-EE-209B**				
Category	Professional Core Courses				
Course title	**Electrical Engineering Materials**				
Scheme and Credits	L	T	P	**Credits**	**Semester- III**
	3	0	0	3	
Course Objectives:	The objectives of this course are • To develop a comprehensive understanding of the electrical and thermal conductivity properties of materials. • To explore magnetic and dielectric properties of materials and their applications. • To analyze magnetic materials and their practical utilization. • To develop an understanding of semiconductor physics for electrical and electronic applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skill demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, properties, classifications, and phenomena associated with conducting, dielectric, magnetic, and semiconductor materials.	Level 1: Remember
CO2	Discuss the electrical, thermal, magnetic, and dielectric behavior of engineering materials and the factors influencing their characteristics.	Level 2: Understand
CO3	Calculate material parameters and electrical characteristics related to conduction, polarization, magnetization, and semiconductor behavior.	Level 3: Apply
CO4	Classify engineering materials based on their electrical, dielectric, magnetic, and semiconductor properties for suitable electrical applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Conductivity of Metal: Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, thermionic emission, photoelectric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.

Unit-II

Dielectric Materials: Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, dielectric losses, significance of the loss tangent, frequency and

temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity.

Unit-III

Magnetic Materials: Introduction, Classification of magnetic materials, diamagnetism, Paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.

Unit-IV

Semiconductors: Energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.

Suggested Readings

- An Introduction to Electrical Engineering by C. S. Indulkar and S. Thiruvengadam, S. Chand Publications.
- Engineering Materials by Kenneth G. Budinski, Prentice Hall of India, New Delhi.
- Electrical Engineering Materials by A. J. Dekker, Pearson Publications.
- A Text Book of Electrical and Electronics Engineering Materials by P. L. Kapoor, Khanna Publishers.
- A Textbook of Electrical Engineering Materials by R. K. Rajput, Laxmi Publications.

Useful Video Links:

Unit No.	Topic	Link
Unit-I	Expression for electrical conductivity in metals	https://www.youtube.com/watch?v=wzWJwjjvu9I
Unit-II	Insulating Materials	https://www.youtube.com/watch?v=-fAphSvtVKA
Unit-III	Magnetic Materials	https://www.youtube.com/watch?v=-fAphSvtVKA
Unit-IV	Semiconductor materials	https://www.youtube.com/watch?v=-5iR1H2nxvo

Course code	**LC-EE-211B**				
Category	Professional Core Courses				
Course title	**Analog Electronics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Understand the characteristics and AC analysis of RC coupled amplifiers, oscillators, regulators and timers. • Developing Knowledge of Rectifiers, Regulators, and Power Supplies • Analyzing and Designing Amplifiers and Oscillators • Application of Operational Amplifiers and Timer Circuits in Signal Processing				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Apply theoretical knowledge to assemble, test, and troubleshoot electronic circuits	Level 3: Apply
CO2	Analyze and interpret the VI characteristics of Zener diodes, MOSFETs, and transistors	Level 4: Analyze
CO3	Evaluate the performance of rectifiers and filters by calculating theoretical and practical ripple factors	Level 5: Evaluate
CO4	Differentiate and compare various feedback topologies	Level 6: Create

List of Experiments

Sr. No.	**Content**
1	To plot VI characteristics of a Zener diode.
2	To study rectifier and the effect of filters on the output of rectifier. Also, calculate the theoretical and practical ripple factor.
3	To analyze and study different types of feedback topology.
4	To analyze and study RC phase shift oscillator.
5	To analyze and study Wein's bridge oscillator.
6	To plot the characteristics of MOSFET.
7	To plot input and output characteristics of transistor configurations.
8	To analyze and study inverting and non-inverting op-amp amplifiers.
9	To analyze and study the 555 timer as a square wave generator.
10	To analyze and study the frequency response of RC coupled amplifier.

11	To analyze and study the working of Push-Pull amplifiers.
12	To analyze and study op-amp amplifiers as a differentiator.
13	To analyze and study op-amp amplifiers as an integrator.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To analyze and study op-amp amplifiers as an integrator.	https://ade2-iitr.vlabs.ac.in/exp/mathematical-operations/
To analyze and study op-amp amplifiers as a differentiator	https://ade2-iitr.vlabs.ac.in/exp/mathematical-operations/
555 timer as a square wave generator	https://aec-iitkgp.vlabs.ac.in/exp/monostable-multivibrator/
Inverting and non-inverting op-amp amplifiers	https://ade2-iitr.vlabs.ac.in/exp/characteristic-parameters/

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course code	**LC-EE-213B**				
Category	Professional Core Courses				
Course title	**Electric Circuit Analysis Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Enhance problem-solving abilities by verifying network theorems, Nodal and Mesh analysis techniques for systematic circuit analysis. • Analyse transient responses of RL and RC circuits and interpret their time-domain behaviour. • Learn to synthesise a network from a given network function and experimentally verify its response. • Evaluate and experimentally verify Z, Y, and T parameters of two-port networks.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Apply various circuit analysis techniques, Nodal Analysis, Mesh Analysis and fundamental theorems.	Level 3: Apply
CO2	Analyze the transient response of RL and RC circuits and examine resonance phenomena in series and parallel AC circuits.	Level 4: Analyze
CO3	Evaluate Z, Y, and T parameters of two-port networks and determine equivalent parameters for various interconnections.	Level 5: Evaluate
CO4	Design and verify network responses by synthesizing a given network function.	Level 6: Create

List of Experiments

Sr. No.	**Content**
1	To study Nodal Analysis.
2	To study Mesh Analysis.
3	To verify Thevenin's theorem in AC circuit.
4	To verify Norton's theorem in AC circuit.
5	To verify Superposition theorem in AC circuit.
6	To verify Maximum Power Transfer Theorem in AC circuit.
7	To Study transient state response of RL and RC circuit.
8	To plot current locus diagram of RL, RC and RLC series circuit.
9	To synthesize a network of give network function and verify its response.
10	To study resonance in series and parallel AC circuits.

11	To evaluate and verify Z, Y and T parameters of a two port network.
12	To determine equivalent parameters of various interconnections of a two port network.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To study Nodal Analysis.	https://pltw.multisim.com/content/rhoaBoJsuRZbvGTWpdmz3E/lab-3-kirchhoffs-laws-and-mesh-and-nodal-analysis/
To study Mesh Analysis.	https://pltw.multisim.com/content/rhoaBoJsuRZbvGTWpdmz3E/lab-3-kirchhoffs-laws-and-mesh-and-nodal-analysis/
To Study transient state response.	https://asnm-iitkgp.vlabs.ac.in/exp/transient-state-response/
To plot current locus diagram of RL, RC and RLC series circuit.	https://asnm-iitkgp.vlabs.ac.in/exp/current-locus-diagrams/
To synthesize a network of give network function and verify its response.	https://asnm-iitkgp.vlabs.ac.in/exp/network-function-synthesis/
To study resonance in circuits.	https://asnm-iitkgp.vlabs.ac.in/exp/resonance-in-circuits/
To evaluate and verify Z, Y and T parameters of a two port network.	https://asnm-iitkgp.vlabs.ac.in/exp/two-port-network/
To determine equivalent parameters of various interconnections of a two port network.	https://asnm-iitkgp.vlabs.ac.in/exp/two-port-network/

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course code	**LC-EE-215B**				
Category	Professional Core Courses				
Course title	**Measurement and Instrumentation Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are to • To understand the construction, working principles, and proper connections of various electrical and electronic measuring instruments. • To develop the ability to calibrate electrical measuring instruments for accurate measurement. • To acquire practical skills in measuring electrical quantities, power, power factor, and circuit parameters using conventional and advanced methods. • To understand the application of transducers for the measurement of physical parameters and their characteristics.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand the construction, working and connection of different types of meters, transducers, strain gauges and star delta starters.	Level 2: Understand
CO2	Apply electrical measuring instruments such as voltmeters, ammeters, wattmeter, and energy meters using appropriate calibration techniques to ensure accurate measurements.	Level 3: Apply
CO3	Analyze accuracy of Measuring instrument for electrical quantities such as resistance, inductance, capacitance, power, and power factor using bridges, CT/PT arrangements.	Level 4: Analyze
CO4	Evaluate the characteristics of transducers such as LVDTs and capacitive sensors, and apply them for displacement and liquid level measurements.	Level 4: Evaluate

List of Experiments

Sr. No.	**Content**
1	To study construction of different types of meters & study how to connect them in a circuit.
2	To calibrate a Voltmeter & an ammeter using a potentiometer.
3	Calibration of AC Wattmeter by Standard Voltmeter and Ammeter.
4	Calibration of single-phase energy meter.
5	To Measure Power & P.F by using 3 ammeter & 3 voltmeter methods.
6	To Measure Power & P.F by two wattmeter method.
7	To measure low resistance by Kelvin double bridge.
8	Measurement of Inductance using Maxwell Bridge.

9	To Measure capacitance by De Sauty bridge.
10	To Measure power with help of CT & PT.
11	Determine output characteristics of LVDT and Measure displacement using LVDT.
12	Measurement of liquid level; using capacitive transducer.
13	To Measure high resistance by loss of charge methods.
14	Determine the unknown Inductance & Q factor by Hay's bridge.
15	Study blocks wise construction of analog Oscilloscope & function generator.
16	To study LAB VIEW.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To study LAB VIEW.	https://www.iitk.ac.in/oscillations/index.html
Study blocks wise construction of analog Oscilloscope & function generator.	https://aec-iitkgp.vlabs.ac.in/?utm_source=chatgpt.com
Determine output characteristics of LVDT and Measure displacement using LVDT.	https://virtual-labs.github.io/exp-lvdt-coep/index.html?utm_source=chatgpt.com
To Measure power with help of CT & PT.	https://vp-dei.vlabs.ac.in/vp-dei/Dreamweaver/?utm_source=chatgpt.com
To measure low resistance by Kelvin double bridge.	https://elms-iitr.vlabs.ac.in/exp/kelvin-sdouble-bridge/simulation/index.html
To measure high resistance by the loss of charge methods.	https://virtual-labs.github.io/exp-loss-of-charge-method

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course code	**LC-EE-217B**				
Category	Professional Core Courses				
Course title	**Electrical Machines-I Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are • To understand the working of DC machines and transformers. • To perform key tests to analyze machine performance. • To develop practical skills in handling electrical equipment.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand the principles of DC machines and transformers.	Level 2: Understand
CO2	Apply testing methods to assess machine performance.	Level 3: Apply
CO3	Analyze machine behavior under different conditions.	Level 4: Analyze
CO4	Evaluate speed control and transformer operation methods.	Level 5: Evaluate

List of Experiments

Sr. No.	**Content**
1	To perform an open-circuit test of a single-phase transformer.
2	To perform short-circuit test of a single-phase transformer.
3	To perform a load test on the single-phase transformer
4	To study the conversion of 3 phase to six phase using 3 single phase transformers.
5	To study the parallel operation of two single-phase transformers.
6	To perform polarity test on the single-phase transformer.
7	To study the Load Characteristics of DC shunt generator.
8	To study the Load Characteristics of DC series motor.
9	To perform the speed control of a DC Motor by field resistance Control and Armature control method.
10	To perform speed control of a DC motor by using Ward-Leonard Method. Draw the graph between armature voltage and speed of motor.
11	To study Hopkinson's test of DC Shunt machine.
12	To study the magnetisation characteristics of DC Shunt Generator. Draw the graph between the armature voltage and field current.

Virtual Lab Links

Experiment Name	Virtual Lab Link
To study the Load Characteristics of DC shunt generator	https://ems-iitr.vlabs.ac.in/exp/load-characteristics-dc-shunt/
To study the speed control of DC Motor by field resistance Control.	https://ems-iitr.vlabs.ac.in/exp/dcmotor-field-resistance-control/simulation.html
To study the speed control of D.C. Shunt motor by armature control method.	https://ems-iitr.vlabs.ac.in/exp/dcshunt-motor-armature-control/
To perform speed control of DC motor by using Ward-Leonard Method. Draw the graph between armature voltage and speed of motor.	https://ems-iitr.vlabs.ac.in/exp/dcmotor-ward-leonard/simulation.html
To study the magnetisation characteristics of DC Shunt Generator. Draw the graph between the armature voltage and field current.	https://ems-iitr.vlabs.ac.in/exp/magnetization-characteristics-dcshunt/

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course Code	**MC-201B**				
Category	Mandatory Courses				
Course Title	**Environmental Science**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	2	0	0	-	
Course Objectives	The objectives of this course are to • Create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources. • Develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health. • Foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society. • Engage students in practical learning through fieldwork and case studies to apply environmental concepts for sustainable development and responsible citizenship.				
Practical/Field Visits	20 Marks				
End Semester Examination	30 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				
Remarks	The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**Level**
CO1	Describe key concepts of environmental studies, types of natural resources, ecosystem structures, pollution types, major environmental laws, and human-environment interactions.	Level 1: Remember
CO2	Explain the interrelationships among ecosystems, biodiversity, pollution, social issues, environmental ethics, and related legislation for sustainable development.	Level 2: Understand
CO3	Apply principles of environmental management, pollution control, disaster preparedness, and sustainable practices in real-world and field-based environmental contexts.	Level 3: Apply
CO4	Analyze environmental problems, population growth impacts, climate change, welfare programs, and the role of information technology in promoting public health and environmental sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I.

Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems.

a) Forest resources: Use and over-exploitation: deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer pesticide problems, Water logging, salinity, case studies. e) Energy resources: Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.

e) Land resources: Land as are source, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, equitable use of resources for sustainable life styles

Unit-II

Ecosystems: Producers, Consumers and Decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, Food web sand ecological pyramids**,** Introduction, types, characteristic features, structure and function of Forest ecosystem, Grass land ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Bio diversity and its conservation: Introduction, Definition, Genetic, Species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wild life, man-wild life conflicts, Endangered and endemic species of India, In-situ and ex-situ conservation of biodiversity.

Unit-III

Environmental Pollution: Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards.

Solids Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies.

Disaster Management: Floods, Earthquake, Cyclone and Landslides.

Social issues and the Environment: From unsustainable to sustainable development, Urban problems related to energy, Water conservation, Rain Water Harvesting, Watershed Management, Resettlement and Rehabilitation of People, its problems and concerns case studies.

Environmental Ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Waste land reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wild life Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Unit-IV

Human population and the Environment: Population growth, Variation among Nations, Population explosion-Family Welfare Programme, Environment and human health, Human Rights. Value Education, HIV/AIDS, Woman and Child Welfare Role of Information Technology in Environment and human health. Case Studies.

Field Work (Field work equal to10 lecture hours)- Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-urban/Rural/Industrial/ Agricultural, Study of

common plants, insects, birds, Study of simple ecosystems-pond, river, hills, slopes, etc.

Suggested Readings:

- Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner.
- The Biodiversity of India by Bharucha, MA Pin Publishing Pvt. Ltd., Ahmedabad.
- Hazardous Waste Incineration by R.C. Brunner, McGraw Hill.
- Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
- Global Biodiversity Assessment by V.H. Heywood & R.T. Watson, Cambridge University Press.
- Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House.
- Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
- Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publication.
- Environmental Chemistry by B.K. Sharma, Goel Publication. House, Meerut.
- Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
- Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
- Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA.
- A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
Unit-II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
Unit-III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

Course Code	**BSC-MEE-202B**				
Category	Basic Science Courses				
Course Title	**Engineering Mathematics-III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are to • Provide fundamental knowledge of partial differential equations, numerical methods, probability, and statistical concepts relevant to engineering problems. • Make the students familiar with analytical and numerical techniques for solving differential equations and problems involving probabilistic and statistical models. • Emphasize the application of appropriate mathematical and statistical methods in the modelling, analysis, and solution of engineering problems.				
Course Pre-requisite	Mathematics up to 12th Standard and Engineering Mathematics-I& II				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall fundamental concepts, definitions, formulae, and standard methods related to partial differential equations, probability and statistics and numerical methods.	Level 1: Remember
CO2	Explain the fundamental concepts of partial differential equations, probability distributions, statistical measures and numerical methods.	Level 2: Understand
CO3	Apply appropriate analytical, numerical and statistical methods and techniques to solve engineering problems.	Level 3: Apply
CO4	Analyze engineering problems to select suitable methods for their solution and interpret the results.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each Unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Definition of Partial Differential Equations, First order linear partial differential equations, Partial Differential Equations of higher order: Second-order linear partial differential equations and their classification, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method, Initial and boundary conditions, Separation of variables method to simple problems in Cartesian coordinates.

Unit-II

Numerical Methods: Solution of polynomial and transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit-III

Measures of central tendency, Moments, Skewness and Kurtosis Basic concept of Probability, Conditional probability, Bayes' theorem, Discrete random variables, Binomial distribution, Poisson distribution, Expectation of discrete random variables, Variance of a sum, Correlation coefficient, Continuous random variables and their properties, Distribution functions, Normal Distribution.

Unit-IV

Testing of hypothesis, Test of significance, large sample test for single proportion, Difference of proportions, Tests for single mean, Difference of means and Difference of standard deviations, Test for ratio of variances, Chi-square test for goodness of fit and Independence of attributes.

Suggested Readings:

- Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers.
- Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publishing Company Limited.
- A text book of Engineering Mathematics by N. P. Bali and Manish Goyal, Laxmi Publications.
- Numerical Methods by P. Kandasamy, K. Thilagavathy, & K. Gunavathi, S. Chand and Company.
- Introductory Methods of Numerical Analysis by S. S. Sastry, PHI learning publication.
- Business Statistics by T.R. Jain, S.C. Aggarwal, VK Global Publications Pvt. Ltd.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Definition of Partial Differential Equations.	https://www.youtube.com/watch?v=KlZqe4UC1jk
	Solution to homogenous and non-homogenous linear partial differential equations	https://www.youtube.com/watch?v=5eZbgxmpK3Q&t=520s
	Initial and boundary conditions of partial differential equations of second order	https://www.youtube.com/watch?v=PVUfuiuWaZQ
Unit-II	Bisection method, Regula-Falsi method and Newton-Raphson method	https://www.youtube.com/watch?v=3j0c_FhOt5U&list=PLU6SqdYcYsfIk1VhXxIYNPFU67ym6gae8
	Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae	https://www.youtube.com/watch?v=Y-yMQvYpltU https://www.youtube.com/watch?v=zdyUwzOm1zw https://www.youtube.com/watch?v=2h0R0Uka1HI
	Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules	https://www.youtube.com/watch?v=EA76ONWBgK4&list=PLhSp9OSVmeyJBkLSO51JFPSEIIoeRiaJy
Unit-III	Basic concept of Probability, Conditional probability, Bays' theorem	https://youtu.be/60vHy2lA4o4 https://www.youtube.com/watch?v=ZFMcWe_SNyI https://www.youtube.com/watch?v=-ELHOnLwE9U
Unit-IV	Testing of Hypothesis & Levels of significance, Large Sample Test	https://auecc.digimat.in/nptel/courses/video/111105090/L72.html
	Chi-Square Test	https://youtu.be/SlCsNb-VXds?feature=shared
	Miscellaneous	https://onlinecourses.nptel.ac.in/noc22_ma81/preview

Course Code	**PCC-EE-204B**				
Category	Professional Core Courses				
Course Title	**Electrical Machines-II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To understand the construction, working principles, and performance of induction machines. ● To learn the operation, characteristics, and control of synchronous machines. ● To gain basic knowledge of special machines and their industrial applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, constructional features, operating principles, characteristics, testing methods, and applications of induction, synchronous, and special electrical machines.	Level 1: Remember
CO2	Discuss the operation, performance characteristics, control methods, testing procedures, and applications of induction, synchronous, and special machines.	Level 2: Understand
CO3	Calculate machine parameters, performance characteristics, speed control methods, voltage regulation, and operating conditions of electrical machines.	Level 3: Apply
CO4	Classify electrical machines based on their construction, operating characteristics, performance, control techniques, and application requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Poly-Phase Induction Motor: Constructional features, Principal of operation, production of rotating magnetic field, speed and slip, frequency of rotor voltage and current, induction motor action, torque production, testing, development of equivalent circuit, performance characteristics, winding emfs, starting methods, double cage and deep bar motors. Methods of speed control - stator voltage control, stator resistance control, frequency control, rotor resistance control, slip power recovery control, efficiency, cogging or magnetic locking, limitations and applications of I.M.

Unit-II

Single-Phase Induction Motors: Introduction, Principle of operation, double revolving field theory, cross-field theory, starting methods, different types of single-phase induction motors, and equivalent circuit of a single-phase induction motor. Induction Generator: Principle of operation, types and applications.
Special Machines: Reluctance motors, Hysteresis motors, servomotors, linear induction motors, stepper motors, step angle and their applications.

Unit-III

Synchronous Generator: Principle, construction of cylindrical rotor and salient pole machines, winding, EMF equation, Armature reaction, testing, model of the machine, regulation – synchronous reactance method, Potier triangle method. Output power equation, power angle curve, Transient and sub-transient reactance, synchronization, parallel operation.

Unit-IV

Synchronous Motor: Principles of synchronous motor, power angle curve, V-curve, starting, hunting, cause and effect of hunting, damper winding, synchronous condenser, Applications: Industrial applications, speed control applications and power factor correction.

Suggested Readings:

- Principle of Electrical Machines by V K Mehta, Rohit Mehta, S Chand.
- Electric Machines by Ashfaq Hussain, Dhanpat Rai.
- Electric Machines by I.J. Nagrath, & D.P. Kothari, TMH, New Delhi.
- Generalized theory of Electrical Machines by P.S. Bhimbra, Khanna Publication.
- Electric Machinery by Fitzgerald and Kingsley, MGH.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Poly-phase Induction Motor	https://youtu.be/leXNHZM-CZE
	Speed and Slip	https://youtu.be/DANGZvHOgj0
Unit-II	Single Phase Induction motors	https://youtu.be/KPMy_L7oyOk
	Equivalent circuit of 1 phase I.M	https://youtu.be/h8386o98deY
Unit-III	Construction of synchronous machine	https://youtu.be/D-uPPjFBKDI
	Armature reaction and synchronous reactance	https://youtu.be/FCKx-1xR4To
Unit-IV	Synchronous motor operation, phasor diagram	https://youtu.be/edJFTap0zYw
	Phasor diagram of salient pole synchronous motor under various conditions	https://youtu.be/hx_QAyjgrNM

Course Code	**PCC-EE-206B**				
Category	Professional Core Courses				
Course Title	**Digital Electronics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To learn the fundamentals of logic simplification using logic gates, Boolean algebra, De Morgan's theorem, and canonical forms (SOP & POS) • To understand mastering number systems, complements, and operations on complement numbers, along with techniques like Karnaugh Maps (up to 6 variables) and the Quine-McCluskey (QM) method for systematic logic reduction • To Design and Analyze Combinational Logic Circuits and Implement Sequential Logic Systems • To Explore Data Conversion Techniques and Programmable Logic Devices				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, logic functions, combinational and sequential circuit elements, data converters, and programmable logic devices used in digital systems.	Level 1: Remember
CO2	Discuss the operation, design principles, and functional characteristics of digital logic circuits, data converters, and programmable logic devices.	Level 2: Understand
CO3	Apply logic simplification, combinational circuit design, sequential circuit design, and data conversion techniques for digital system applications.	Level 3: Apply
CO4	Analyze digital circuits, sequential systems, data converters, and programmable logic devices based on their characteristics, performance, and application requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Digital Systems and Binary numbers: Digital signals, digital systems, advantages of digital systems, logic levels, signed binary numbers, complement binary arithmetic, binary codes, BCD arithmetic, error detecting and correcting codes.

Digital Logic Families: Types of logic families, voltage levels, noise margin, power dissipation, fan-in and fan-out, CMOS logic.

Unit-II

Gate Level Minimization: Canonical and standard forms, POS and SOP simplifications, K-Map method, Q-M method, don't care conditions, NAND and NOR implementations, integrated circuits

Unit-III

Combinational Logic: Design and analysis of combinational circuits – adders, carry look ahead adder, subtractors, multiplier, magnitude comparators, encoders, demultiplexers and multiplexers.

Unit-IV

Sequential Logic: Design and analysis of sequential circuits – latches, flip-flops, registers and counters.
A/D and D/A converter: Introduction to Digital to analog converters: weighted resistor/resistor divider converter, R-2R Ladder D/A converter, specifications for D/A converters, Introduction to analog to digital converters: sample and hold circuit, quantization and encoding, parallel comparator A/D converter, counter type A/D converter, successive approximation A/D converter, dual slope A/D converter.

Suggested Readings

- Modern Digital Electronics by R.P. Jain, Tata McGraw Hill, 4th edition.
- Switching Theory & Logic Design by A. Anand Kumar, PHI.
- Digital Electronics Circuit and System by V K Puri, TMH.
- Digital Circuits and Systems by D.V. Hall, Tata McGraw Hill.
- Principle of Digital Electronics by K Meena, PHI learning.
- Logic & Computer Fundamentals by Morris Mano,4th Edition, Pearson Education.

Useful Video Links

Unit No.	Topics	Links
Unit-I	Boolean Algebra	https://www.youtube.com/shorts/xtAYbY_Pz7I
Unit-II	Multiplexer	Introduction to Multiplexer | What are Multiplexers | Digital Electronics
	Combinational Circuits	https://www.youtube.com/watch?v=fXrbYMDevDU
Unit-III	Sequential Circuits	https://www.youtube.com/watch?v=S0mKCNLmCh4&list=PLgwJf8NK-2e4mEQv0ttgW-am4wiqrpdcX
	Counter	https://www.youtube.com/watch?v=NTCrCYPoA5A&list=PLgwJf8NK-2e6lcDg0NxW-_yO6Bl5dPBp8
Unit-IV	Finite state machines	https://www.youtube.com/watch?v=LOZxYBOKRLg

Course Code	**PCC-EE-208B**				
Category	Professional Core Courses				
Course Title	**Power Systems-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of the evolution, structure, and components of modern power systems, including substations, bulk grids, micro-grids, and AC/DC distribution systems. • To develop the ability to calculate line parameters, analyze transmission line models, voltage regulation, reactive power compensation, and evaluate distribution system performance. • To understand sag and stress analysis, effects of environmental conditions, and insulation design for reliable and safe power transmission. • To study cable types, corona effects, and HVDC transmission technology for efficient and advanced power delivery.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, components, parameters, transmission systems, distribution systems, insulation systems, cables, and HVDC technologies used in power systems.	Level 1: Remember
CO2	Discuss the structure, operation, performance characteristics, mechanical design aspects, insulation requirements, and transmission technologies of power systems.	Level 2: Understand
CO3	Calculate transmission line parameters, performance indices, sag and stress values, cable characteristics, and voltage control measures for power system applications.	Level 3: Apply
CO4	Analyze power system components, transmission and distribution configurations, insulation systems, cable technologies, and HVDC transmission schemes based on operational and performance requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

INTRODUCTION: Evolution and Growth of Power Systems in India. Deregulation in power, Environmental aspects of energy generation, Structure of a power system, Distributed generation, Bulk Power Grids and Micro-grids, indoor and outdoor substations, equipment for substations, layout, auxiliary supply.

BASIC TERMINOLOGY IN POWER SYSTEMS: Reserve generating capacity, maximum load, annual load factor, capacity factor, diversity factor, and tariffs.
DISTRIBUTION SYSTEMS: Radial, ring mains, and network distribution systems, comparison of various types of AC and DC systems.

Unit-II

CALCULATION OF TRANSMISSION LINE PARAMETER: Inductance of line: Definition, Inductance of 1-Ø two-wire line, Inductance of composite conductor line, Inductance of 3-Ø single line, Inductance of 3-Ø double line, and Proximity effect. Resistance of line and Skin effect.
Capacitance of line: Definition, Capacitance of 1-Ø two-wire line, Capacitance of 3-Ø line with symmetrical and unsymmetrical spacing, Effect of earth on transmission line capacitance, Ferranti effect.
PERFORMANCE OF POWER TRANSMISSION LINE: Classification of transmission line: short, medium, and long transmission lines, Equivalent circuit, Interpretation of long line, tuned power line, power flow through a transmission line, method of voltage control, and Circle diagram.

Unit-III

MECHANICAL DESIGN: Catenary curve, Sag-tension calculation, effect of ice and wind, Sag at different support levels, stringing chart, dampers.
INSULATORS: Types, insulating materials, voltage distribution over the insulator string, and the method of equalizing the potential over the insulator in a string.
INSULATED CABLES: Insulating material and its requirement, EHV cables, grading of cables, insulation resistance of cable, capacitance of single core cable, and Current rating of cable. Types of cable, Comparison of overhead and underground cable.

Unit-IV

CORONA: Phenomenon of corona, derivation for critical disruptive voltage and visual critical disruptive voltage, power loss, factor affecting corona loss, advantages and disadvantages, radio interference, method of reduction in corona losses,
HVDC TRANSMISSION: Need for HVDC transmission; types of links (monopolar, Bipolar, and homopolar), advantages and limitations of HVDC transmission.

Suggested Readings

- Power System Analysis & Design by J. D. Glover, M.S. Sarma and T. J. Overbye, Cengage Learning India Pvt. Ltd.
- Power Systems Analysis by A.R. Bergen, & V. Vittal, Pearson Education.
- Power System Stability & Control by P. Kundur, Tata McGraw Hill, 2006.
- Electric Power Systems by B.M. Weedy, & B.J. Cory, Wiley India.
- Elements of Power System Analysis by J. J. Grainger, & W.D. Stevenson., Tata McGraw-Hill Publishing Company Limited.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Structure of Power systems	https://youtu.be/Yg6XsepGCKY?list=PLD4ED2FAF3C155625
Unit-II	Transmission line parameters	https://youtu.be/lr1jgbR5ca8?list=PLD4ED2FAF3C155625
Unit-III	Sag and Tension Analysis	https://youtu.be/Gz10k08xdDk
Unit-IV	Grading of cables	https://youtu.be/Csw1OTdWu_8?list=PLD4ED2FAF3C155625

Course Code	**PCC-CSE-207B**				
Category	Engineering Science Courses				
Course Title	**Python Programming**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce Python programming basics, including syntax, data types, and control structures. • To develop skills in Python data structures, functions, and recursion. • To explore Python's graphical programming, image processing, and GUI development. • To explain object-oriented programming, exception handling, and multithreading concepts.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define key terminology of Python syntax, data types, control structures, data structures, libraries, and GUI tools.	Level 1: Remember
CO2	Explain the functionality of Python programming constructs, data handling techniques, and graphical modules.	Level 2: Understand
CO3	Use Python programs for data processing, file handling, numerical computing, graphics, and GUI applications.	Level 3: Apply
CO4	Analyze Python programming constructs, data structures, libraries, graphics, image processing, and GUI techniques to solve real-world problems effectively.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Introduction: Installing Python; basic syntax, interactive shell, editing, saving, and running a script; data types; variables, assignments; numerical types; arithmetic operators and expressions; Loops and selection statements, Control statements String manipulations: subscript operator, indexing, slicing a string; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file.

Unit-II

Lists, Tuple, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; Tuple: creating tuples, accessing elements, tuple immutability, operations, tuple methods, tuples vs. lists; dictionary literals, adding, and removing keys, accessing and replacing values;

traversing dictionaries. Hiding redundancy, complexity; arguments and return values; Program structure and design. Recursive functions.

Unit-III

Introduction to NumPy: NumPy arrays, Array Indexing and Slicing, Array Operations, Array Manipulation, Linear Algebra with NumPy, Random Number Generation and Statistics.
Introduction to Pandas: Pandas Series, Pandas Data Frames, Data Frame Indexing and Selection, Data Cleaning and Preprocessing, Data Manipulation, Group by Operations, Merging, Joining, and Concatenating Data Frames, Input/Output Operations.

Unit-IV

Simple graphics and image processing: Simple graphics, Turtle operations, manipulating turtle screen, drawing two dimensional shapes, examining an object attribute, taking a random walk, Color and RGB scheme, Image processing: Image manipulation operations, properties of images, image module, copying, blurring and reducing image.
Graphical User Interfaces using Tkinter: Terminal based and GUI based programs, Introduction to Tkinter, Simple GUI-Based Programs, Windows and Window Components, Input and Output with Entry Fields, Defining and Using Instance Variables, Other Useful GUI Resources.

Suggested Readings:

- Fundamentals of Python: First Programs by Kenneth Lambert, Course Technology, Cengage Learning, 2012.
- Introduction to Computer Science Using Python: A Computational Problem-Solving by Dierbach, C. Focus, John Wiley & Sons, (2012).
- Let Us Python by A. Kanetkar, & Y. Kanetkar, BPB Publications.
- Python – The Complete Reference by M. C. Brown, McGraw Hill Education.
- Core Python Programming by R. N. Rao, Dream Tech Press.
- Python Programming: Using Problem Solving Approach by R. Thareja, Oxford University Press.
- Python Programming by S. Sridhar, J. Indumathi, & V. M. Hariharan, Pearson Education.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Variables and Input Statement	https://youtu.be/ruQb8jzkGyQ
Unit-II	List operators	https://youtu.be/jMShssechMI
Unit-III	Graphical User Interfaces using Tkinter	https://youtu.be/-GhzpvvIXlM?list=PLS1QulWo1RIY6fmY_iTjEhCMsdtAjgbZM
Unit-IV	Fundamentals of Object Oriented Programming	https://youtu.be/K3g4srbkUNM?list=PLLy_2iUCG87Ah844iZW3w3nzWSTA8KSZA

Course code	**LC-EE-210B**				
Category	Professional Core Courses				
Course title	**Electrical Machines-II Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To study performance and circuits of induction and synchronous motors. • To explore speed control and voltage effects on motor performance. • To understand voltage regulation and load-sharing in generators. • To learn alternator synchronization and fault analysis techniques.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand performance and circuits of induction and synchronous machines.	Level 2: Understand
CO2	Apply and demonstrate different load test and speed control methods for induction machines and synchronous machines.	Level 3: Apply
CO3	Analyze the different performance curves like torque-speed and V-curves to optimize machine performance.	Level 4: Analyze
CO4	Assess the operation of synchronous generators in parallel, perform synchronization, and determine key parameters like voltage regulation.	Level 5: Evaluate

List of Experiments

Sr. No.	**Contents**
1	To perform the open circuit test and block rotor test on 3 phase induction motor and draw the circle diagram
2	To perform the speed control of an induction motor by rotor resistance control.
3	To conduct the load test to determine the performance characteristics of the I.M.
4	To compute the torque v/s speed characteristics for 3-phase induction motor.
5	To perform the open circuit test and blocked rotor test on a single-phase induction motor and determine equivalent circuit parameters
6	To perform O.C. test on synchronous generator and determine the full load regulation of a three phase synchronous generator by impedance method.
7	To perform and Measure Synchronous Impedance and Short Circuit Ratio of Synchronous Generator.

8	Study of Power (Load) sharing between two Three Phase alternators in parallel operation Condition.
9	To plot V- Curve of synchronous motor.
10	Synchronization of two Three Phase Alternators by a) Synchro scope Method b) Three dark lamp Method c) Two bright one dark lamp Method.
11	Determination of sequence impedances of synchronous machine for various stator voltages.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To Study No Load Test on Three Phase Induction Motor.	https://em-coep.vlabs.ac.in/exp/no-load-test-induction-motor/
To Study blocked rotor test on 3 Phase Induction Motor.	https://em-coep.vlabs.ac.in/exp/blocked-rotor-test-induction-motor/
To study the torque speed characteristics of a three phase induction motor.	https://bes-iitr.vlabs.ac.in/exp/three-phase-induction-motor/
To Study Open Circuit Test on Three Phase Alternator.	https://em-coep.vlabs.ac.in/exp/open-circuit-phase-alternator/index.html
To Study Short Circuit Test on Three Phase Alternator.	https://em-coep.vlabs.ac.in/exp/short-circuit-phase-alternator/index.html
To plot V Curves and Inverted V curves of Three Phase Synchronous Motor	https://em-coep.vlabs.ac.in/exp/synchronous-motor/
To Study Load Test on Three Phase Alternator	https://em-coep.vlabs.ac.in/exp/load-test-phase-alternator/index.html

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course code	**LC-EE-212B**				
Category	Professional Core Courses				
Course title	**Digital Electronics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Understand digital logic fundamentals by studying basic and universal gates and minimising Boolean functions using K-map. • Analyse and design combinational circuits such as adders, subtractors, multiplexers, and demultiplexers. • Design and verify sequential circuits including flip-flops, counters, and sequence detectors. • Gain practical knowledge of data conversion through the design and verification of ADC and DAC.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand and demonstrate the working of basic logic gates and realize logic functions using universal gates.	Level 2: Understand
CO2	Analyze and simplify logic expressions up to five and six variables using the Karnaugh Map (K-Map) method for optimal circuit design.	Level 4: Analyze
CO3	Implement and validate the truth tables of S-R, J-K, T, and D type flip-flops to understand sequential circuit fundamentals.	Level 5: Evaluate
CO4	Design and test data conversion circuits, such as ADC and DAC for digital-analogue interfacing and 3-bit synchronous counters, synchronous UP/DOWN decade counters using JK flip-flops, and asynchronous counters.	Level 6: Create

List of Experiments

Sr. No.	**Content**
1	To study & design basic gates.
2	To study and realize logic functions with the help of universal gates.
3	To realize and minimize five & six variables using K-Map method.
4	To verify the operation of Multiplexer & De-multiplexer.
5	To perform Half adder and Full adder
6	To perform Half Subtractor and Full Subtractor.
7	To verify the truth table of S-R, J-K, T & D Type flip-flop.
8	To design & verify the operation of 3 bit synchronous counter.
9	To design & verify the operation of synchronous UP/DOWN decade counter using JK flip
10	To design & verify operation of Asynchronous counter.

11	To design and implement a circuit to detect a count sequence.
12	To design & verify operation of ADC & DAC.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To study & design basic gates.	https://de-iitr.vlabs.ac.in/exp/truth-table-gates/
To verify the truth table of S-R, J-K, T & D Type flip-flop.	https://de-iitg.vlabs.ac.in/exp/truth-tables-flip-flops/
To perform Half adder and Full adder	https://de-iitg.vlabs.ac.in/exp/half-adder-full-adder/
To perform Half Subtractor and Full Subtractor.	https://de-iitr.vlabs.ac.in/exp/half-full-subtractor/

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course code	**LC-EE-214B**				
Category	Professional Core Courses				
Course title	**Power Systems-1 Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	0	0	2	1	
Course Objectives	The objectives of this course are • To enable the design and performance evaluation of transmission and distribution systems. • To enhance understanding of transmission line phenomena. • To develop proficiency in modeling and analyzing power system components using MATLAB. • To analyze and compare the performance of distribution systems under various configurations.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Apply Power system blocks in MATLAB, corona loss in transmission line, mechanical design of transmission line.	Level 3: Apply
CO2	Analyze the proximity and skin effect.	Level 4: Analyze
CO3	Assess Line Parameters, ABCD Parameters, performance of transmission line, Ferranti effect.	Level 5: Evaluate
CO4	Design long and short transmission lines using MATLAB.	Level 6: Create

List of Experiments

Sr. No.	**Content**
1	To synthesize the Power System blocks in MATLAB.
2	To design short and long transmission line using MATLAB.
3	To study and calculate the transmission line parameters.
4	To study the Corona loss in the power distribution system.
5	To study the proximity and skin effect.
6	To find ABCD parameters of a model of transmission line.
7	To study performance of a transmission line under no load condition & load at different power factors.
8	To observe the Ferranti effect in a model of transmission line.
9	To study performance characteristics of a typical DC distribution system in radial & ring main configurations.
10	To study mechanical design of the transmission line.

Virtual Lab Links

Experiment Name	Virtual Lab Link
To study the Power System blocks in MATLAB.	https://in.mathworks.com/help/sps/ref/powersystemssimulationonramp.html?utm
To design short and long transmission line using MATLAB.	https://support.mathworks.com/matlabcentral/fileexchange/43340-long-transmission-line-matlab-simulation-by-rohit-kanojia?utm
To study the corona loss in power distribution system.	https://vm-dei.vlabs.ac.in/index_home.php
To study the proximity and skin effect.	https://sa-nitk.vlabs.ac.in/exp/plc-normal-load-operation/theory.html?utm_
To find ABCD parameters of a model of transmission line.	https://asnm-iitkgp.vlabs.ac.in/exp/two-port-network/procedure.html
To study performance of a transmission line under no load condition & under load at different power factors.	https://www.academia.edu/31466035/A_Virtual_Electric_Power_Transmission_Line_Lab
To study performance characteristics of typical DC distribution system in radial & ring main configuration.	https://sa-nitk.vlabs.ac.in/exp/monitoring-feeder-parameter/theory.html
To study mechanical design of transmission line.	https://lntedutech.com/power-transmission-line-engineering/?utm

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course code	**LC-CSE-213B**				
Category	Engineering Science Course (Lab Course)				
Course title	**Python Programming Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To introduce students to the basic syntax, data types, control structures, and functions in Python programming. ● To enable students to implement mathematical, searching, and sorting algorithms using Python programming constructs. ● To provide hands-on experience with file handling, object-oriented programming, and Python libraries such as Turtle, OpenCV, and Tkinter. ● To develop students' ability to analyze algorithmic logic, debug programs, and optimize solutions using Python.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Understand fundamental Python programming constructs such as input/output, operators, control flow, and functions.	Level 2: Understand
CO2	Write Python programming techniques to implement algorithms for mathematical operations, searching, and sorting.	Level 3: Apply
CO3	Apply file handling, libraries (Turtle, OpenCV, Tkinter) and OOP concepts in Python to solve practical problems.	Level 3: Apply
CO4	Analyze the logic, performance, and correctness of Python solutions for problems involving algorithms and data.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**
1	Write a Program to compute the G.C.D of two numbers.
2	Write a Program to find the square root of a number.
3	Write a Program to find the power of a number.
4	Write a Program to find the maximum in a list of numbers.
5	Write a Program to implement linear search in a list.
6	Write a Program to implement binary search in a list.
7	Write a Program to sort the element using selection sort.
8	Write a Program to sort the element using insertion sort.
9	Write a Program to sort the element using merge sort.
10	Write a Program to first "n" prime numbers.
11	Write a Program to find the most frequent word in a text file.
12	Write a Program in Python for a random walk using turtle.
13	Write a Program in Python using Tkinter/OpenCV to rotate an image.

14	Create a GUI based login page in Python language.
15	Write a program to implement inheritance in Python.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topics beyond the syllabus.

Course Code	**PEC-EE-216B**				
Category	Professional Elective Courses				
Course Title	**Wind and Solar Energy Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals of wind energy, including wind characteristics, energy conversion principles, turbine classification, and system components. • To understand modern wind turbine technologies and the characteristics of various electrical generators used in wind energy systems, such as induction and synchronous generators. • To provide knowledge of solar thermal energy systems, including solar radiation measurement, collector types, orientation, and thermal performance analysis for practical applications. • To familiarise students with solar photovoltaic technology, covering solar cell fundamentals, types, performance evaluation, and Maximum Power Point Tracking (MPPT) for efficient PV system design.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, components, technologies, characteristics, and performance parameters associated with wind and solar energy systems.	Level 1: Remember
CO2	Discuss the principles of wind energy conversion, wind turbine operation, solar thermal systems, photovoltaic energy conversion, and MPPT techniques.	Level 2: Understand
CO3	Apply energy conversion parameters, solar radiation quantities, wind turbine performance indices, and photovoltaic system characteristics for renewable energy applications.	Level 3: Apply
CO4	Analyze wind energy systems, wind turbine generators, solar thermal collectors, photovoltaic technologies, and energy conversion methods based on their characteristics and performance requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Wind Energy: Basic History of wind power, Indian and Global statistics, Characteristics of Wind, principles of wind energy conversion, components of wind energy conversion system, classification of wind turbines- horizontal axis and vertical axis, Betz limit ratio, advantages and disadvantages of wind energy system.

Unit-II

Wind Turbine Technologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbine, Squirrel-cage Induction generator, Wound rotor induction generators, Doubly Fed Induction Generator, Synchronous Generators, Permanent Magnet Synchronous Generators and their characteristics.

Unit-III

Solar Thermal: Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Unit-IV

Solar Photovoltaic: Photovoltaic energy conversion, solar cell fundamentals, solar cell classification-Amorphous, mono-crystalline, polycrystalline, performance of solar cell, V-I characteristics of a PV panel, Maximum Power point Tracking (MPPT) algorithm.

Suggestions Redding:

- Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 2014.
- Wind Energy Theory and Practice by Siraj Ahmed publisher PHI learning Pvt Ltd.
- Renewable Energy Sources and Emerging Technologies by D.P Kothari, K.C Singal, Rakesh Ranjan , PHI learning Pvt Ltd.
- Renewable Energy resources by Tiwari, & Ghosal, Narosa.
- Solar Photo Voltaics Fundamentals, Technology and application by Chetan Singh Solanki, PHI learning Pvt Ltd.
- Renewable Energy Resources by John Twidell and Tony Weir, Taylor and Francis.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Power Generation from Wind Energy	https://youtu.be/k7LX0a67V8A
Unit-II	Turbine Terms	https://youtu.be/z7HV-ixAjs4
Unit-III	Solar Radiation	https://youtu.be/Og4LEc7SpdQ
Unit-IV	Solar Collectors	https://youtu.be/__co3m8nVUg

Course Code	**PEC-EE-218B**				
Category	Professional Elective Courses				
Course Title	**Electromagnetic Fields Theory**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • Familiarize yourself with various coordinate systems and electromagnetic vector fields. • Impart knowledge on the concepts of electrostatic, magneto static and electrodynamic Fields. • Disseminate concepts related to electromagnetic waves, Waveguides and applications of electromagnetic fields. • Understand transmission line equation and wave propagation in different medium.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, vector operations, field quantities, electromagnetic laws, wave parameters, and Maxwell's equations used in electromagnetic field theory.	Level 1: Remember
CO2	Discuss the behavior of electrostatic, magnetostatic, and time-varying electromagnetic fields, including field interactions and wave propagation phenomena.	Level 2: Understand
CO3	Apply electromagnetic field quantities, potentials, forces, energies, and wave propagation parameters using appropriate field equations and theorems.	Level 3: Apply
CO4	Analyze electromagnetic field distributions, boundary conditions, material responses, and wave propagation characteristics based on their physical and mathematical properties.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Vector Analysis: Review of scalars, vectors, vector multiplication- dot and vector products, component of a vector, Co-ordinate system- Cartesian, cylindrical and spherical co-ordinate system. Transformation of different co-ordinate system. Gradient, Curl and Divergence. Divergence theorem, Stroke's theorem. Line integrals, Surface integrals, Volume integrals, Differential length, area and Volume in Cartesian, cylindrical and spherical co-ordinate system. Dirac- Delta function.

Unit-II

Electrostatic Fields: Overview of electrostatic field, Coulomb's Law and field intensity. Electric fields due to point charge, continuous charge distributions like line charge, surface charge and volume charge distributions.

Electric flux density, Gauss's Law, Electric potential, Relationship between E and V - Maxwell's equation. Scalar potential. Electric Dipole, Electric field intensity due to electric dipole. Electric flux lines. Properties of Electric flux lines due to point charge and dipole. Energy density in Electrostatic field.

Convection and Conduction currents and current densities. Conductors, Point form of Ohm's law, Continuity equation of current and Relaxation time. Electrostatic Boundary conditions, Poisson's and Laplace's equations.

Unit-III

Magneto Static Fields: Introduction to magneto static fields, Biot-Savart's law. Ampere's circuit law, Magnetic flux density, Magnetic scalar and vector potentials, Forces due to magnetic fields - Force on a charged particle, Force on a current element and Force between two current elements, Magnetic Dipole, Classification of magnetic materials, Magnetic boundary conditions. Inductance for simple geometry. Magnetic energy, Statement and Interpretation of Maxwell's equation.

Unit-IV

Time Dependent Fields: General introduction, Faraday's Law, Transformer and motional emf, stationary loop in time varying B field, Moving loop in static B field (Motional emf). Moving loop in time varying fields, Displacement current. Maxwell's equation in Final forms, Introduction of Electromagnetic wave propagation, waves in general, wave propagation in lossy dielectric. Plane waves in loss less Dielectric, Plane waves in free space, Plane waves in good conductors. Power and Poynting vector.

Suggestions Redding

- Engineering Electromagnetics by W H Hayt Jr, J A Buck, & M Jaleel Akhtar, McGraw Hill Education.
- Outline of Electromagnetics by Mahmood Nahvi, A. Joseph, & Edminister, Schaum's, McGraw Hill Education.
- Fundamental of Electromagnetic by Karl E. Lonngren, Sava Savov, & Randy J. Jost, Scitech Publishing Inc.
- Electromagnetics by J. Edminister, & Vishnu Priye, Schaum's Series.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Review of scalar and vector fields	https://www.youtube.com/watch?v=gEa38ldV_a0&pp=0gcJCdgAo7VqN5tD
Unit-II	Electric flux density,	https://www.youtube.com/watch?v=gJtxcGEg5R0
	Gauss's Law. Application of Gauss's law	https://www.youtube.com/watch?v=whv_d-fBCg0
Unit-III	Biot-Savart's law, Ampere's law	https://www.youtube.com/watch?v=4YEQ98NUWOY
	Forces due to magnetic fields; Vector potential	https://www.youtube.com/watch?v=Nwnj1JSvfnk
Unit-IV	Faraday's Law	https://www.youtube.com/watch?v=deI8cJiCKEo
	Maxwell's equation	https://www.youtube.com/watch?v=ibF0L6X53tg

Course Code	**PEC-EE-220B**				
Category	Professional Elective Courses				
Course Title	**Special Electrical Machines**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To learn the fundamental principles, constructional features, and performance characteristics of poly-phase and single-phase AC machines, including induction motors, commutator motors, servo motors, and synchronous motors. • To impart knowledge of advanced control techniques for efficient machine operation. • To familiarize students with special-purpose electrical machines and their applications. • To prepare students for industrial and research-oriented applications in modern electrical drives.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the knowledge of advanced control techniques for efficient machine operation.	Level 1: Remember
CO2	Explain the construction, operating principles, and performance characteristics of various poly-phase and single-phase AC machines	Level 2: Understand
CO3	Apply different control techniques for achieving constant torque and constant power operation in induction motors.	Level 3: Apply
CO4	Analyze performance and characteristics of special-purpose machines for specific industrial and automation applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Poly-Phase AC Machines: Construction and performance of double cage and deep bar three phase induction motors, production of rotating magnetic field, induction motor action, e.m.f. induced in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power), stator voltage control, stator resistance control, frequency control, rotor resistance control, slip power recovery control, induction motor as an induction generator.

Unit-II

Single-Phase Induction Motors: Construction, equivalent circuit, starting characteristics and applications of split phase, capacitor start, capacitor run, capacitor start capacitor-run and shaded pole motors.

Single-Phase Commutator Motors: Construction, principle of operation, characteristics of universal and repulsion motors; Linear Induction Motors. Construction, principle of operation, applications.

Two Phase AC Servo Motors: Construction, torque-speed characteristics, performance and applications.

Unit-III

Stepper Motors: Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications.

Switched Reluctance Motors: Construction; principle of operation; torque production, modes of operation, drive circuits.

Unit-IV

Permanent Magnet Machines: Permanent magnet DC motors, sinusoidal PM AC motors, brushless DC motors and their important features and applications, PCB motors. Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors.

Suggestions Redding:

- Principle of Electrical Machines by V K Mehta & Rohit Mehta, S Chand.
- Electric Machines by Ashfaq Hussain, Dhanpat Rai.
- Electric Machines by I.J. Nagrath, & D.P. Kothari, TMH, New Delhi.
- Generalized theory of Electrical Machines by P.S. Bhimbra, Khanna Publication
- Electric Machinery by Fitzgerald, & Kingsley, MGH.
- Principles of Electrical Machines and Power Electronics by P.C. Sen, John willey & Sons.
- Fundamentals of Electric Drives by G.K. Dubey, Narosa Publishing House.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Static Slip power Recovery	https://youtu.be/6DctdwlDKhc
Unit-II	Single phase Induction Motor	https://youtu.be/trlmCvmUybk
Unit-III	Variable Reluctance Motor	https://youtu.be/1IiY6YlPHck
Unit-IV	Permanent Magnet Machines	https://youtu.be/dGvSJ25bor4

Course Code	**PEC-EE-224B**				
Category	Professional Elective Courses				
Course Title	**High Voltage Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To develop a fundamental understanding of conduction and breakdown mechanisms in different dielectric media. • To impart knowledge of generation and measurement techniques for high voltages and currents. • To impart knowledge of generation and measurement techniques for high voltages and currents. • To familiarise students with high-voltage testing procedures for various electrical apparatus.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, breakdown mechanisms, high-voltage generation methods, measurement techniques, insulation coordination principles, and testing procedures used in high-voltage engineering.	Level 1: Remember
CO2	Discuss the conduction and breakdown phenomena in dielectric materials, high-voltage generation and measurement techniques, overvoltage effects, and insulation coordination practices.	Level 2: Understand
CO3	Determine appropriate methods for high-voltage generation, measurement, insulation assessment, non-destructive testing, and testing of electrical apparatus.	Level 3: Apply
CO4	Analyze dielectric breakdown processes, overvoltage conditions, insulation performance, testing methods, and high-voltage equipment characteristics based on operational requirements and performance criteria.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (preferably 1 from each Unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each Unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Conduction and Breakdown in Gases: Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.

Conduction and Breakdown in Liquid Dielectrics: Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.
Breakdown in Solid Dielectrics: Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

Unit-II

Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators.
Measurement of High Voltages and Currents: Measurement of High DC Voltages, Measurement of High AC and Impulse Voltages, Measurement of High DC, AC, and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements.

Unit-III

Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems: National Causes for Over-voltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems.

Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.

Unit-IV

HV Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment.

Suggestions Redding

- High Voltage Engineering by M.S. Naidu, & V. Kamaraju, McGraw Hill Latest Edition.
- High Voltage Engineering Fundamentals by E. Kuffel, W.S., & J. Zaengl, Kuffel Newness Latest Edition.
- High Voltage Engineering by C.L. Wadhwa, New Age International Latest Edition.
- High Voltage Engineering by A.M. Farouk, Rizk CRC Press Latest Edition.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Breakdown in dielectrics	https://youtu.be/5S6xQT05Cw4
Unit-II	Introduction to HVDC Transmission	https://youtu.be/yP7OACmLP48
Unit-III	Design and Selection of Insulation	https://youtu.be/ga8moSgeO34
Unit-IV	HV Testing of Equipment	https://youtu.be/sDBstxApMqE

Annexure AC/5.26

~~ANNEXURE 4.6~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme & Syllabus

Under NEP-2020 (B-Scheme)

For

Minor/Honors (Hons.)/Specialization Degree

in

Electric Vehicles

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

Minor in Electric Vehicles

w.e.f. 2026-27

Sr. No.	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in (hr.)
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	MEEEV201B	Fundamentals of Electric Vehicles	3	0	0	3	3	30	45		75	3
2	IV	MEEEV202B	Introduction to Electric and Hybrid Vehicles	3	1	0	4	4	40	60		100	3
3	V	MEEEV301B	Battery Cell Technology for EV	3	0	0	3	3	30	45		75	3
4	VI	MEEEV302B	Electric Vehicle Dynamics and Electric Motor Drives	3	0	0	3	3	30	45		75	3
5	VII	MEEEV401B	Charging Infrastructure	3	0	0	3	3	30	45		75	3
6	III	MEEEV203B	Fundamentals of Electric Vehicles Lab	0	0	2	2	1	10		15	25	3
7	VI	MEEEV304B	Power Electronics and Drives for EVs Lab	0	0	2	2	1	10		15	25	3
8	VII	MEEEV403B	Project	0	0	4	4	2	20		30	50	3
Total Credits								**20**				**500**	

Note: To earn the required credits for the award of B.Tech Minor/Honors (Hons.)/Specialization Degree, students may choose either:

(i) To enroll in courses offered through NPTEL/MOOCs that must be equivalent to the prescribed courses in the approved scheme, subject to availability in any semester.

OR

(ii) To complete the prescribed courses in the same semester as offered by the department under the approved scheme and curriculum structure.

Course Code	**MEEEV201B**				
Category	Professional Core Courses				
Course Title	**Fundamentals of Electric Vehicles**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are: • To understand the basics, components, and classification of Electric and Hybrid Vehicles and their comparison with ICE vehicles. • To learn vehicle fundamentals, performance, transmission, and braking systems for EVs and HEVs. • To gain knowledge of electric motors, their characteristics, and power electronic converters used in EVs • To analyse hybrid architectures and perform powertrain sizing for EVs and HEVs.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts, components, classifications, and history of Electric and Hybrid Electric Vehicles.	Level 1: Remember
CO2	Explain vehicle resistances, performance parameters, EV/HEV layouts, architectures, motors, and converter operations.	Level 2: Understand
CO3	Apply formulas to compute tractive effort, torque, braking performance, and size EV/HEV powertrain components.	Level 3: Apply
CO4	Analyze and compare EV and HEV technologies, motor characteristics, and powertrain architectures to evaluate performance.	Level 4: Analyse

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 9 marks each will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit.

Unit-I

Electric Vehicles: History, Basics of Electric Vehicles, Components of Electric Vehicles, General Layout of EV, EV classification & Comparison with Internal Combustion Engine: Technology, Advantages & Disadvantages of EV, National Policy for adoption of EVs.

Unit-II

Vehicle Fundamentals: Vehicle resistance, Types: Rolling Resistance, grading resistance, Aerodynamic drag, vehicle performance, calculating the Acceleration Force, maximum speed, finding the Total Tractive Effort, Torque required on the Drive Wheel, Transmission: Differential, clutch & gearbox, Braking performance.

Hybrid Electric Vehicles: History, Components of Hybrid Electric Vehicle, General Layout of Hybrid EV, Comparison with Electric Vehicles, Advantages & Disadvantages of Hybrid EV.

Unit-III

Vehicle Architecture & Design: Hybrids Based on Architecture, Hybrids Based on Transmission Assembly, Hybrids Based on Degree of Hybridisation. Power Train Component Sizing: EV Powertrain sizing, HEV Powertrain Sizing, HEV Powertrain Sizing Example.

Unit-IV

Motors and Converters: Principle and working of DC Motor, Characteristics & Types of DC Motors- Overview, Speed Torque characteristics of Permanent magnet Motor, BLDC Motor, and Induction motor, Comparison of all motors. Introduction of DC-DC, AC-AC, AC-DC, DC-AC converters, four-quadrant operation, Driver circuits.

Suggested Readings:

- Electric Vehicle Technology Explained by John Lowry and James Larminie, Wiley.
- Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, External, and Design by Mehrdad Ehsani and Yimin Gao, CRC Press.
- Electric and Hybrid Vehicles: Design Fundamentals by Iqbal Hussain, CRC Press.
- Build Your Own Electric Vehicle by Seth Leitman and Bob Brant, McGraw Hill.
- Introduction to Hybrid Vehicle System Modeling and Control by Wei Liu.
- Electric and Hybrid Electric Vehicles by I.Husain ,CRC Press 2003, second edition.

Useful Video links:

Unit No.	Topics	Links
Unit-I	Basics of Electric Vehicles	https://nptel.ac.in/courses/108106170
	Components of an Electric Vehicle	https://nptel.ac.in/courses/108106170
Unit-II	Hybrid Electric Vehicles	https://youtu.be/_xM7X8k9g0s
Unit-III	Power Train Component Sizing	https://youtu.be/61VupMVdIK8
Unit-IV	Principle and working of DC Motor	https://youtu.be/NiHPu5PltCY
	BLDC Motor	https://youtu.be/EcXIxNf-4Ws?list=PLJpKI3Fm4KzzxxDzhkObVrU_iaL1cm4u_

Course Code	**MEEEV202B**				
Category	Professional Core Courses				
Course Title	**Introduction to Electric and Hybrid Vehicles**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are: • To understand the evolution of transportation, fundamentals of EVs, and their environmental, social, and economic impacts. • To study configurations and operating principles of EVs, HEVs, PHEVs, and fuel cell vehicles. • To gain knowledge of EV propulsion systems, motors, power electronics, control, and charging technologies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of EVs, HEVs, ICE vehicles, components, charging systems, and policies.	Level 1: Remember
CO2	Explain the working principles of EV propulsion, energy storage, motors, power electronics, and technology comparisons.	Level 2: Understand
CO3	Apply EV system concepts to select suitable configurations, motors, batteries, and charging methods.	Level 3: Apply
CO4	Analyze EV systems, infrastructure, thermal management, safety, policies, and future mobility trends.	Level 4: Analyze

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit.

Unit-I

Introduction to Electric Vehicles, History & Impact: History of Transportation, History and Resurgence of Vehicular Electrification, Challenges and Way Forward for EVs, Environmental, Social, and Economic Impact of EV Adoption.

Vehicle Dynamics and Internal Combustion Engine (ICE) Basics: Vehicle Dynamics – I, Vehicle Dynamics – II, Overview, Operation and Characteristics of ICE Vehicles, Comparison of ICE Vehicles and Electric Vehicles.

Unit-II

Electric Vehicles & Hybrid Electric Vehicle (HEV) Configuration: Basics of Electric Vehicles, Hybrid EV Configuration and Operation – I, Hybrid EV Configuration and Operation – II, Hybrid EV Configuration and Operation – III.

Plug-in HEV, Fuel Cell Vehicles & Technology Comparison: Plug-in Hybrid Electric Vehicle (PHEV) and Operation, Fundamentals of Hydrogen Fuel Cell Vehicle (FCV), Power Management Techniques, Comparison of EV, HEV, PHEV, and FCV Technologies.

Unit-III

EV Propulsion Systems Motors, Control and Charging Technologies: Electric Propulsion System Structure and Components, Power Electronics Converters in EV Powertrains, Electronic Control Unit (ECU) in EV & HEVs, Ultracapacitors, Flywheels and Fuel Cell Technology. Induction Motor, PMSM, BLDC and SRM Motors – Principles & Control, EV Charging Infrastructure in India, Types of EV Charging, Architecture and Working of EV Charging Systems, Operation and Control of EV Charging Systems, AC-DC Converters with PFC, DC-DC Converters, RES Integration for EV Charging, Wireless EV Charging Systems.

Unit-IV

Thermal Management & Safety in EVs: EV Thermal Management Guidelines, Battery Thermal Management, Thermal Management of Motors and Power Converters, Safety Standards in EVs, Battery Recycling Guidelines.

Policies, Standards & Future Trends in EV Infrastructure: Policies and Economics for Grid Integration of EV Charging, Charging Specifications & Standards in EV Industry, Business Models and Economics of Vehicular Electrification, Role of Artificial Intelligence (AI) in EV Systems, Concept of Vehicle-to-Everything (V2X) and Smart Mobility.

Suggested Readings:

- Modern Electric Vehicle Technology, by C.C. Chan and K.T. Chau, Oxford University Press.
- Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, by Ehsani, M., Gao, Y., Longo, S., and Ebrahimi, K., CRC Press, 2018.
- Electric and Hybrid Vehicles: Design Fundamentals, by Iqbal Husain, Third Edition, CRC Press, 2021.
- Electric Propulsion System for Electric Vehicular Technology: A Review, by Kumar, Lalit, and Shailendra Jain, Renewable and Sustainable Energy Reviews 29 (2014): 924-940.

Useful Video links:

Unit No.	Topics	Links
Unit-I	Introduction to Electric Vehicles	https://youtu.be/gDOnBwjF55U?list=PLZnygY81tHUyzqioA7oXed6qsztizMH8c
	Vehicle Dynamics	https://nptel.ac.in/courses/107106080
	Impact of EV Adoption	https://youtu.be/tBMHJ-6Wflk
Unit-II	Basics of Electric Vehicles	https://youtu.be/3E1SXG7VkQk?list=PLyqSpQzTE6M9spod-UH7Q69wQ3uRm5thr
Unit-III	DC-DC Converters with control for EV Charging	https://youtu.be/ZWv2AGLiXqQ
Unit-IV	Battery Thermal Management	https://youtu.be/Y5NOQWTqJIo

Course Code	**MEEEV301B**				
Category	Professional Core Courses				
Course Title	**Battery Cell Technology for EV**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	3	0	0	3	
Course Objectives	The objectives of this course are: • To understand the principles of electrochemical energy storage by studying battery fundamentals. • To analyze battery materials, energy storage mechanisms, and degradation phenomena in lithium-ion and emerging battery technologies. • To study battery materials, energy storage mechanisms, and degradation. • To develop knowledge of cell engineering, electrochemical characterization techniques, battery management systems, and integration of batteries into electric vehicles				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall electrochemical cell fundamentals, kinetics concepts, battery materials, and basic cell engineering principles.	Level 1: Remember
CO2	Explain thermodynamics, overpotentials, energy storage mechanisms, electrochemical techniques, and battery performance in EVs.	Level 2: Understand
CO3	Apply electrochemical equations, kinetic models, material concepts, and diagnostic techniques to analyze battery behavior and safety.	Level 3: Apply
CO4	Analyze cell design, degradation, modelling, BMS integration, and EV adoption challenges using electrochemical and engineering principles.	Level 4: Analyse

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 9 marks each will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit.

Unit-I

Electrochemical Cell Fundamentals: Electrochemical cells: conversion of reaction rate to current density, conversion of potential to Gibbs free energy, Faraday constant (C and Ah), non-faradaic current and capacitor behavior, metal–solution interface, galvanic potential. Electrochemical series, galvanic and electrolytic cells, Nernst equation. Basic definition of cells, anatomy of a cell, internal processes, cell materials and chemistry.

Unit-II

Kinetics, Voltage Losses & Battery Performance: Voltage losses and kinetics: overpotential (activation, ohmic, concentration), Butler–Volmer kinetics, Tafel kinetics, Faraday's laws, coulombic efficiency. Cells in vehicles and battery metrics, cell power and C-rate (fast charging), battery performance challenges, battery life and degradation, battery safety and thermal runaway.

Unit-III

Battery Materials & Energy Storage Mechanisms: Primary and secondary batteries, Li/Li-ion batteries, Na-ion battery materials. Anode and cathode materials, non-aqueous electrolytes, solid electrolyte interface (SEI), cathode electrolyte interface (CEI). Energy storage mechanisms (intercalation, conversion, alloying), irreversible capacity loss, theoretical capacity, volume strain, zero-strain materials, solid-state and superionic conductors.

Unit-IV

Cell Engineering, Characterization & EV Integration: Cell requirements and specifications, cell technology roadmap (current, near-term, long-term), cell manufacturing process, design and sizing, cell cost. Cell modelling and diagnostics. Electrochemical techniques: cyclic voltammetry, chronoamperometry, chronopotentiometry, differential pulse voltammetry, galvanostatic charge–discharge, dQ/dV analysis, impedance spectroscopy, GITT, symmetric cell analysis, Li^+ transport number. Battery pack design, internal management, BMS, battery reuse and recycling, EV adoption in India: challenges and recommendations.

Suggested Readings:

- Electric and Hybrid Vehicles: Design Fundamentals by Iqbal Hussain, CRC Press,2003.
- Modern Electric, Hybrid Electric and Fuel Cell Vehicles- Fundamentals, External and Applications by Mchrdad Ehsani, Yimi Gao, Sebastian E.gay and Ali Emadi, CRC Press, 2004.
- Electric Vehicles Technology Explained by James Larminie, John Lowry, Wiley Publications, 2013.
- Super capacitors- materials, Systems and Applications by F. Beguin and E. Frackowiak, Wiley-VCH Verlag GmbH & Company, 2013.
- Fuel Cells and Hydrogens: From Fundamentals to Applied Research by V. Hacker, S.Mitsushima, Elsevier, 2018.
- Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, By John G. Hayes and G. Abas Goodarzi, Wiley Publication.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Electrochemical Cell Fundamentals	https://youtu.be/9Z-FrvcPa-E?si=RCRgvDFnaVwjCtSo
Unit-II	Kinetics, Voltage Losses & Battery Performance	https://youtu.be/Eb7pv0oOf_k?si=e7LZtnTDyRTBzjcL https://youtu.be/62363H_I_Qk?si=josMfPpSDNBK_lat
Unit-III	Battery Materials & Energy Storage Mechanisms	https://youtu.be/no4vRKvKxcU?si=5odxvOC0iEQr13Go
Unit-IV	Cell Engineering, Characterization & EV Integration	https://www.youtube.com/live/tU8YKLKPMMA?si=iKFoxaEo_0E4fveh

Course Code	**MEEEV302B**				
Category	Professional Core Courses				
Course Title	**Electric Vehicle Dynamics and Electric Motor Drives**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals of electric vehicles and develop an understanding of vehicle dynamics and traction requirements. • To impart knowledge of electric motor drive systems, including DC and induction motor drives, used in electric vehicle applications. • To develop competency in modelling and control of advanced motor drives such as PMSM, IM vector control, and switched reluctance motor drives. • To enable analysis and evaluation of power electronic converters and motor drive architectures through practical case studies of modern electric vehicles.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify fundamentals of electric vehicles, vehicle dynamics, motor drives, and power electronic converters.	Level 1: Remember
CO2	Explain vehicle dynamic modelling, operating principles of DC, induction, PMSM, BLDC and SRM drives, and control concepts.	Level 2: Understand
CO3	Apply modelling and control techniques for vehicle dynamics, motor drives, vector control, and PWM converters in EV systems.	Level 3: Apply
CO4	Analyze and compare EV drive systems, motor control strategies, converter topologies, and real-world EV case studies.	Level 4: Analyse

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 9 marks each will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit.

Unit-I

Introduction to Electric Vehicles and Vehicle Dynamics: Introduction to electric vehicles and classification of Evs, Components and architecture of electric vehicles, Fundamentals of vehicle dynamics, Forces acting on electric vehicles, Longitudinal vehicle dynamics modelling, Tractive effort, rolling resistance, aerodynamic drag and gradient resistance, Basics of vehicle dynamics simulation for electric vehicles.

Unit-II

DC Drives and Induction Motor Drives for Electric Vehicles: Fundamentals of electric drives and power electronics for electric vehicle applications, DC motor characteristics and applications in Evs, Modelling and control of DC motor drives, Basics of induction motors. Mathematical modelling of induction motor, V/f control technique for induction motor drives, Power electronic converters and PWM techniques for induction motor drives.

Unit-III

PMSM Drives and Vector Control Techniques: Introduction to Permanent Magnet Synchronous Motors for EV applications. Modelling of PMSM drives. Mathematical modelling of general cylindrical rotor machines in a stationary reference frame. Concept of rotating reference frames. Modelling of PMSM in rotor flux-oriented reference frame. Vector control of PMSM drives. Sensored vector control of PMSM drive. Advanced modelling and control aspects of PMSM for electric vehicles.

Unit-IV

Advanced Motor Drives and EV Case Studies: Modelling of an induction motor in rotor flux oriented reference frame, Sensored and sensor-less vector control of induction motor drives, Magnetic materials and B-H curve characteristics, Principle of operation of a switched reluctance motor, Configurations of SRM and computation of step angle, Power converter realisation and control of SRM, Basics of BLDC motor drives, Converter realisation and control of BLDC drives, Case study of high-end electric vehicles and their drive systems.

Suggested Readings

- R. Krishnan, "Electric Motor Drives - Modeling, Analysis & Control", PHI Learning Private Ltd, 2009.
- L. Ashok Kumar, S. Albert Alexander, "Power Converters for Electric Vehicles", CRC Press, Taylor & Francis Group, 2021
- James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
- C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001

Useful Video links

Unit No.	Topics	Links
Unit-I	**Introduction to Electric Vehicles and Vehicle Dynamics**	https://youtu.be/L2HbpEMfryM?si=QghjLafduLlt6_rD
Unit-II	**DC Drives and Induction Motor Drives for Electric Vehicles**	https://youtu.be/bHrWjMVOpag?si=F0gviD5fgVkbkmqb
Unit-III	**PMSM Drives and Vector Control Techniques**	https://youtu.be/apM4GUnqLo?si=fJoR2wLw9XbQNMpr
Unit-IV	**Advanced Motor Drives and EV Case Studies**	https://youtu.be/ZAzTH4HOUvc?si=jWhIEOyyCLzEYHr9

Course Code	**MVEEE401B**				
Category	Professional Core Courses				
Course Title	**Charging Infrastructure**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VII**
	3	0	0	**3**	
Course Objectives	The objectives of this course are: • To understand the fundamentals of EV charging systems, EVSE types, classifications, and standards. • To learn the principles, modelling, and control of AC–DC converters used in EV chargers. • To examine isolated DC-DC converters and their control strategies. • To analyze charging procedures, communication protocols, and overall challenges in modern EV charging infrastructure.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic concepts of EV charging systems, EVSE types, charging classifications, and standards.	Level 1: Remember
CO2	Explain the operating principles and control of AC–DC and isolated DC–DC converters used in EV chargers.	Level 2: Understand
CO3	Apply suitable converter topologies and control methods for different EV charging applications.	Level 3: Apply
CO4	Analyze charger performance, losses, soft-switching, protocols, and communication (Type-2, CCS-2) in EV charging systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts (1 from each unit/section) of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Charging System: Electric Vehicle Supply Equipment (EVSE) for on-board charger, EVSE for off-board charger, Charging Infrastructure Challenges, Classification and standards.

Unit-II

AC-DC power converters: Various types of AC-DC converters, Single phase Boost derived topologies: operating principles, modelling and control, Single phase Bridgeless topologies: operating principles, modelling and control, Three phase AC-DC converter: operating principles, modelling and control

Unit-III

Isolated DC-DC converters: Various types of isolated converters, Losses and soft-switching criteria, Phase-shift full bridge: operating principles and control, Dual active bridge: operating principles, modulation and control.

Unit-IV

Charging procedure, protocols and communication: AC type2, DC CCS2 charging system.

Suggested Readings:

- Automotive Electrical and Electronic Systems, by Tom Denton, 5th Edition, Routledge, 2018.
- Electric and Hybrid Vehicles: Design Fundamentals, by Iqbal Husain, CRC Press, 2021.
- Fundamentals of Power Electronics, by Robert W. Erickson, and Dragan Maksimovic, 3rd, Springer, 2020.
- Power Electronics: Essentials and Applications, by L.Umanand, Wiley India, 2012.
- Power Electronics – Converters, Applications and Design, by Mohan N., Underland T.M. and Robbins W.P., 3rd Ed., Wiley India.

Useful Video links:

Unit No.	Topics	Links
Unit-I	**Introduction to Charging System**	https://youtu.be/xPIFmwKonu8
	Electric Vehicle Supply Equipment (EVSE) for on-board charger	https://nptel.ac.in/courses/108107715
	EVSE for off-board charger	https://nptel.ac.in/courses/108107715
Unit-II	**Single phase Boost derived topologies**	https://nptel.ac.in/courses/108107715
	Three-phase AC-DC converter	https://youtu.be/rACh_DwIf7E
Unit-III	**Various types of isolated converters**	https://nptel.ac.in/courses/108107715
	Dual active bridge	https://youtu.be/XsicKDSRQhk
	Phase-shift full bridge	https://youtu.be/YINqDUxMemQ
Unit-IV	**AC type2 charging system**	https://nptel.ac.in/courses/108107715
	DC CCS2 charging system	https://youtu.be/cEaVn-3aSNk

Course Code	**MEEEV403B**				
Category	Project Courses				
Course Title	**Project**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VII**
	0	0	4	**2**	
Course Objectives	The objectives of this course are: • To identify suitable research topics in Electrical Engineering for independent investigation. • To understand research methodologies, documentation, and referencing aligned with existing literature. • To develop technical writing skills using appropriate tools, formats, and referencing techniques. • To analyze, interpret, and synthesize research findings within a defined research scope or topic.				
Assessment	20 Marks				
End Semester Examination	30 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Identify complex engineering problems relevant to project work based on domain knowledge and real-world challenges.	Level 1: Remember
CO2	Describe the workflow, technical background, and tools required for planning and executing engineering projects.	Level 2: Understand
CO3	Apply appropriate methods, tools, and techniques to carry out project development and prepare technical documentation.	Level 3: Apply
CO4	Analyze the key stages of project development to ensure systematic execution and identify performance issues.	Level 4: Analyze
CO5	Evaluate alternative approaches and select suitable methodologies to achieve optimal and feasible project outcomes.	Level 5: Evaluate
CO6	Design innovative and practical engineering solutions to address societal and industrial needs.	Level 6: Create

Project Guidelines:

- Students shall undertake projects individually or in small teams (2–4 members).
- Projects must be approved by the department project committee before commencement.
- Regular progress reviews will be conducted throughout the semester.

Course code	**MEEEV203B**				
Category	Lab Courses				
Course title	**Fundamentals of Electric Vehicles Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- III**
	0	0	2	1	
Course Objectives	The objectives of this course are: ● To understand and apply DC/AC power conversion techniques. ● To analyze performance and control of electrical machines and transmission systems. ● To explore electric/hybrid vehicle technologies and efficiency comparisons.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated	RBT Level
CO1	**Understand** the working principles of converters, electrical machines, and automotive systems.	Level 2: Understand
CO2	**Apply** simulation and experimental methods to study power electronic devices and motor control.	Level 3: Apply
CO3	**Analyze** performance of motors, transmission, and braking systems.	Level 4: Analyze
CO4	**Evaluate** efficiency and compare electric/hybrid vehicles with conventional IC engines.	Level 5: Evaluate

List of Experiments

Sr. No.	Content
1	Experiment for the conversion of DC-to-DC voltage using a converter.
2	Simulation for AC-to-AC conversion.
3	Simulation for AC to DC conversion.
4	Simulation for DC to AC conversion.
5	Study of 3-Phase Induction Motor.
6	Speed control of a DC motor using an IGBT.
7	To perform speed reversal of the DC Shunt Motor.
8	Study of various elements of transmission systems (Clutch, Differentials, Gearbox, etc.)
9	Calculate and compare the Brake Power and Mechanical Efficiency of an IC Engine and an electrical motor of the same configuration.
10	Study of various types of Braking systems.
11	Case study of any Electric/ Hybrid car manufactured/sale in India.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments if they feel useful to add.

Course code	**MEEEV304B**				
Category	Professional Core Courses (Lab Course)				
Course title	**Power Electronic Drives and Controllers for Electric Vehicle Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are: • To develop the skills related to Power Electronics drives. • To analyze the important parameters for converters and Controllers				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain characteristics of power devices and electrical machines.	Level 2: Understand
CO2	Apply test procedures to control speed of DC and AC motor drives.	Level 3: Apply
CO3	Analyze the characteristics of converter-fed AC & DC motor drives.	Level 4: Analyze
CO4	Evaluate drive performance by experimental and simulation results.	Level 5: Evaluate

List of Experiments

Sr. No.	**Content**
1	To draw V-I characteristics of power diode.
2	To draw the V-I characteristics of a Schottky diode.
3	To draw V-I characteristics of IGBT & GTO.
4	To perform a load test on a DC shunt motor.
5	To perform speed control of a DC shunt motor.
6	To draw speed-torque characteristics of a DC series motor.
7	Modelling and simulation of Permanent Magnet Brushless DC motor with MATLAB/Simulink.
8	Modelling and simulation of a switched reluctance motor with MATLAB/Simulink.
9	To perform single phase bridge converter drive
10	To perform single phase AC motor control drive
11	To draw Speed – Torque Characteristics of a 3-phase Induction Motor using a VSI Inverter
12	To draw Speed – Torque Characteristics of a 3-phase Induction Motor using a CSI Inverter

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To draw the V-I characteristics of the IGBT	https://pe-iitr.vlabs.ac.in/exp/bipolar-transistor/simulation.html
To draw the V-I characteristics of a power diode.	https://pe1-iitd.vlabs.ac.in/exp/controlled-switching/
To perform single phase bridge converter drive	https://pe1-iitd.vlabs.ac.in/exp/single-phase-controlled/
To perform single phase AC motor control drive	https://pe1-iitd.vlabs.ac.in/exp/single-phase-voltage-controller/

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Annexure AC/5.27

DEPARTMENT OF FIRE TECHNOLOGY AND SAFETY
GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR
An Autonomous Institute | NAAC 'A' Grade Institute | Affiliated to MDU, Rohtak

MINUTES OF THE 4TH MEETING OF THE BOARD OF STUDIES OF THE DEPARTMENT OF FIRE TECHNOLOGY AND SAFETY HELD ON 11TH JUNE, 2026

The 4th Meeting of the Board of Studies of the Department of Fire Technology and Safety was held on 11th June, 2026 at 10:00 a.m. in the Board Room of the Institute.

Members Present:

Sr. No.	Name of Member	Designation / Affiliation	Category
1	Dr. Jitender Kumar	Department of Fire Technology and Safety, GITAM	Chairperson, Board of Studies
2	Prof. Vineet Singla	Professor UIET, MDU Rohtak	University Nominee
3	Sh. R.C. Sharma	Professor of Practice, IP University, Delhi (Retd. Director, Delhi Fire Service)	Subject Expert (Outside the Parent University)
4	Dr. Amir Ali Khan	National Institute of Disaster Management (NIDM), New Delhi *(Online Mode)*	Subject Expert (Outside the Parent University)
5	Mr. Sujit Kumar	Vice President, BPTP	Industry Expert
6	Dr. Paramjeet Sangwan	Professor (Mathematics), GITAM	Internal Member
7	Dr. Dipika	Professor (Management), GITAM	Internal Member
8	Dr. Sunil Kadiyan	Associate Professor, GITAM	Internal Member
9	Mr. Nikhil Sikka	Assistant Professor, GITAM	Internal Member
10	Mr. Manoj Kumar	Assistant Professor, GITAM	Internal Member
11	Mr. Bhoop Singh	Assistant Professor, GITAM	Internal Member
12	Mr. Vikas Goel	Assistant Professor, GITAM	Internal Member
13	Mr. Vishnu	Assistant Professor, GITAM	Internal Member
14	Mr. Rajkumar Ruhil	Assistant Professor, GITAM	Internal Member
15	Mr. Ashish Kumar	Assistant Professor, GITAM	Internal Member
16	Dr. Suman Lata	Associate Professor, GITAM	Internal Member
17	Dr. Aarti	Assistant Professor, GITAM	Internal Member

At the outset, the Chairperson welcomed all the members and thanked them for their valuable presence. The agenda items were taken up for discussion as follows:

Item 4.1 Confirmation of the minutes of 3rd meeting of the Board of Studies of Fire Technology and Safety Department held on 22nd Dec., 2025.

To confirm the minutes of 3rd meeting of the Board of Studies of Fire Technology and Safety Department held on 22nd Dec., 2025 **(Annexure 4.1 Pages 1-3 already circulated).**

RESOLVED THAT THE MINUTES OF 3RD MEETING OF THE BOARD OF STUDIES OF FIRE TECHNOLOGY AND SAFETY DEPARTMENT HELD ON 22ND DEC., 2025 (ANNEXURE 4.1 PAGES 1-3 ALREADY CIRCULATED) BE CONFIRMED.

Item 4.2 **Follow-up action report on the decisions taken in the 3rd meeting of the Board of Studies of Fire Technology and Safety Department held on 22nd Dec., 2025.**

To note the follow-up action on the decisions taken in the 3rd meeting of the Board of Studies of Fire Technology and Safety Department held on 22nd Dec., 2025 **(Annexure 4.2 Pages 4 already circulated).**

RESOLVED THAT THE FOLLOW-UP ACTION ON THE DECISIONS TAKEN IN THE 3RD MEETING OF THE BOARD OF STUDIES OF FIRE TECHNOLOGY AND SAFETY DEPARTMENT HELD ON 22ND DEC., 2025 (ANNEXURE 4.2 PAGES 4 ALREADY CIRCULATED) BE NOTED.

Item 4.3 **Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Fire Technology and Safety) and B.Tech (Fire Technology and Safety-Working Professionals) 3rd Year *w.e.f.* 2026-27.**

The Scheme of Studies & Examinations and Syllabi (A-Scheme) for the 2nd Year of B.Tech. (Fire Technology and Safety) and B.Tech. (Fire Technology and Safety – Working Professionals) was approved by the Board of Studies in its meeting held on 26th May, 2025 and subsequently approved by the Academic Council. The proposed Scheme of Studies & Examinations and Syllabi for the 3rd Year, *w.e.f.* the academic session 2026–27, is placed before the Board as **Annexure 4.3 Pages 5–72.**

The Board of Studies may consider and approve the proposed Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech (Fire Technology and Safety) and B.Tech (Fire Technology and Safety-Working Professionals) of 3rd year.

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (A-SCHEME) OF B.TECH (FIRE TECHNOLOGY AND SAFETY) AND B.TECH (FIRE TECHNOLOGY AND SAFETY- WORKING PROFESSIONALS) OF 3RD YEAR (ANNEXURE 4.3 PAGES 5–72).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.4 **Syllabi of Open Elective Courses offered by Fire Technology and Safety Department for B.Tech. 3rd Year (Scheme-A) effective from the Academic Session 2026–27.**

To approve the syllabi of the Open Elective Courses offered by Fire Technology and Safety Department for B.Tech. 3rd Year (Scheme-A) **(Annexure 4.4 Pages 73-76)** effective from the Academic Session 2026–27.

Sr. No.	Course Code	Course	Offered by	Departments Eligible to Choose the Course
1	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
2	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
3	---------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

RESOLVED THAT THE SYLLABI OF OPEN ELECTIVE COURSES OFFERED BY FIRE TECHNOLOGY AND SAFETY DEPARTMENT AS MENTIONED ABOVE FOR B.TECH. 3RD YEAR (SCHEME-A), EFFECTIVE FROM THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.4 PAGES 73-76) BE APPROVED.

FURTHER RESOLVED THAT THE APPROVED SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.5 Scheme of Studies & Examinations and Syllabi of B.Tech (Fire Technology and Safety) and B.Tech (Fire Technology and Safety-Working Professionals) 2nd year (B-Scheme as per NEP-2020) *w.e.f.* 2026-27.

The Institute implemented NEP-2020 *w.e.f.* 2025-26 (For 1st Year). The Scheme of Studies & Examinations and Syllabi have been proposed accordingly for 2nd year common to the B.Tech (Fire Technology and Safety) and B.Tech (Fire Technology and Safety-Working Professionals) **(Annexure 4.5 Pages 77-138).** The revised scheme shall be designated as the B-Scheme in accordance with NEP-2020.

The Board of Studies may consider and approve the Scheme of Studies & Examinations and Syllabi (B-Scheme) common for 2nd year of B.Tech (Fire Technology and Safety) and B.Tech (Fire Technology and Safety-Working Professionals).

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (B-SCHEME) COMMON FOR B.TECH (FIRE TECHNOLOGY AND SAFETY) AND B.TECH (FIRE TECHNOLOGY AND SAFETY-WORKING PROFESSIONALS) (ANNEXURE 4.5 PAGES 77–138).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.6 Proposal to start the Minor/Honours Degree Programme in Sustainable Energy Engineering (SEE)

With a view to enhancing employability and imparting in-depth knowledge in emerging areas not covered in the regular curriculum, it is proposed to introduce a Minor/Honours Degree Programme in Sustainable Energy Engineering (SEE). The programme shall carry 18–20 credits in addition to the credits required for the award of the regular undergraduate degree, in accordance with Table 11.4 of the AICTE Approval Process Handbook (List of Courses for Minor Degree/Honours in Emerging, Multidisciplinary, and Region-Specific Areas).

Minor / Hons Degree	To be offered as Hons., Only for following Major Disciplines (For any other Major Disciplines which is not mentioned, it may be offered as Minor Degree)
Sustainable Energy Engineering (SEE)	Applicable to any discipline of Engineering and Technology

The Board of Studies may consider and approve the Minor/Honours Degree Programme in Sustainable Energy Engineering (SEE) along with the Scheme of Studies & Examinations and Syllabi **Annexure 4.6, Pages 139–181.**

RESOLVED THAT THE BOARD OF STUDIES CONSIDERED AND APPROVED THE MINOR/HONOURS DEGREE PROGRAMME IN SUSTAINABLE ENERGY ENGINEERING (SEE) ALONG WITH THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (ANNEXURE 4.6, PAGES 139-181).

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI OF THE MINOR/HONOURS DEGREE PROGRAMME IN SUSTAINABLE ENERGY ENGINEERING (SEE) IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.7 Panel of Examiners for Theory and Practical Examinations of B.Tech. Programme for Academic Session 2026-27.

The Board of Studies, in its meeting held on 22nd Dec., 2025 vide its Resolution No. 3.4, approved the Panel of Examiners. The Board of Studies may now review the existing panel to ensure the inclusion of additional eligible and qualified examiners, if required, to further strengthen the evaluation process for the upcoming academic year.

RESOLVED THAT THE BOARD OF STUDIES REVIEWED AND APPROVED THE PANEL OF EXAMINERS FOR THEORY AND PRACTICAL EXAMINATIONS FOR THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.7, PAGE 182).

FURTHER RESOLVED THAT THE APPROVED PANEL BE FORWARDED TO THE CONTROLLER OF EXAMINATIONS FOR FURTHER NECESSARY ACTION.

Item 4.8 Any other item with the permission of Chair

There being no other item for discussion, the meeting concluded with a vote of thanks to the Chair.

Dr. Jitender Kumar
Chairperson, Board of Studies
Department of Fire Technology and Safety
Ganga Institute of Technology and Management, Jhajjar

Annexure AC/5.28

~~Annexure 4.3~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme & Syllabus For

3rd Year

Bachelor of Technology Fire Technology and Safety

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

B.Tech (Fire Technology and Safety)– 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-FT-301A	Fire Safety Risk Assessment	3	0	0	3	3	40	60		100	3
2	Professional Core Courses	PCC-FT-303A	Fire Dynamics	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	PCC-FT-305A	Fire Safety Codes and Standards	3	0	0	3	3	40	60		100	3
4	Engineering Science Courses	ESC-ME-307A	Strength of Materials	3	0	0	3	3	40	60		100	3
5	Professional Core Courses	PCC-FT-309A	Fire Protection	3	0	0	3	3	40	60		100	3
6	Professional Elective Courses	Refer Table 2	Professional Elective-II	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	LC-FT-311A	Fire Dynamics Lab	0	0	2	2	1	25		25	50	3
8	Engineering Science Courses	LC-ME-313A	Strength of Materials Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	LC-FT-315A	Fire Ground Operations-V	0	0	2	2	1	25		25	50	3
10	Internship	INT-FT-317A	Internship Seminar-I	0	0	2	2	1	50		-	50	3
11	Mandatory Non Credit Courses – Audit Courses	MC-301A	Essence of Indian Traditional Knowledge	2	0	0	2	-	40	60	-	100	3
Total Credits								**22**				**800**	

Notes:

I. MC-301A is a mandatory non –credit course in which the students will be required passing marks in theory. However these marks will not be added in the total marks.

II. They may also opt for Massive Open Online Courses (MOOCs) offered through SWAYAM, SWAYAM Plus, or NPTEL platforms subject to approval by the concerned Chairperson, Board of Studies (BoS)/Head of the Department.

Table 2 Professional Elective – II

Sr. No.	Code	Subject
1	PEC-FT-319A	Special Fire Hazards
2	PEC-FT-321A	Offshore Structures under Special Environmental Loads including Fire Resistance
3	PEC-FT-323A	Fire Service Communication and Mobilizing
4	PEC-FT-325A	Fire and Life Safety Audit
5	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

B.Tech (Fire Technology and Safety) – 6th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-FT-302A	Fire Testing	3	0	0	3	3	40	60		100	3
2	Professional Core Courses	PCC-FT-304A	Fire Appliances and Rescue Equipments	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	PCC-FT-306A	Automobile Engineering Safety	2	0	0	2	2	40	60		100	3
4	Professional Elective Courses	Refer Table 3	Professional Elective-III	3	0	0	3	3	40	60		100	3
5	Open Elective Courses	Refer Table 4	Open Elective-I	3	0	0	3	3	40	60		100	3
6	Humanities and Social Sciences including Management courses	HSMC-FT-308A	Energy Environment Ethics and Society	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	LC-FT-310A	Fire Testing Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	LC-FT-312A	Automobile Safety Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	LC-FT-314A	Basic Computer Skills and AutoCAD Lab	0	0	2	2	1	25		25	50	3
10	Professional Core Courses	LC-FT-316A	Fire Ground Operations-VI (Rescue Operations)	0	0	2	2	1	25		25	50	3
Total Credits								**21**				**800**	

Notes:

I. At the end of the 6th Semester, each student shall undergo 4–6 weeks of Practical Training in any one of the following areas: Fire and Safety, Fire and Safety Equipment Installation, Care and Maintenance, Fire and Safety Audits, or any certificate course related to Fire and Safety (minimum contact hours: 30 hours). The training may be undertaken in a Fire Service Department, Industry, Multi-Speciality Hospital, Professional Organization, Research Laboratory, Training Centre, Educational Institute, or any other building occupancy having fire-fighting installations. The student shall submit a typed training report along with a certificate issued by the concerned organization. The evaluation of the training shall be carried out in the 7th Semester.

II. **For Working Professionals:** Students shall submit a Training/Project Report based on their work in their respective company/organization for the period of the summer/industrial training. The evaluation shall be carried out in the 7th Semester.

III. Students must choose one course from the Professional Elective–III category (Table 3) and one course from the Open Elective–I category (Table 4). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table 3 Professional Elective – III

Sr. No.	Code	Subject
1	PEC-FT-318A	Fire Modelling
2	PEC-FT-320A	Safety Practice in Chemical and Nuclear Industries
3	PEC-FT-322A	Building Design and Drawing
4	PEC-FT-324A	Industrial Hygiene and Occupational Health
5	PEC-FT-326A	Nuclear Reactors and Safety
6	PEC-FT-328A	Computational Fluid Dynamics
7	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Table 4 Open Elective Courses – I

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

Course Code	**PCC-FT-301A**				
Category	Professional Core Courses				
Course Title	**Fire Safety Risk Assessment**				
Scheme and Credits	L	T	P	**Credits**	**Semester -V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the concepts of hazards, risk assessment and fire safety evaluation in industrial and engineering systems. • To develop understanding of risk analysis methodologies, accident causation theories and safety performance measurement techniques. • To familiarize students with qualitative and quantitative risk assessment tools used for identification and evaluation of fire and industrial hazards. • To provide knowledge of human reliability analysis techniques and their role in accident prevention and safety management				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe hazards, risk, accident causation, fire risk scenarios and safety performance parameters used in fire safety risk assessment and evaluation.	Level 1: Remember
CO2	Explain the principles of hazard identification, qualitative and quantitative risk assessment, accident analysis and human reliability evaluation techniques.	Level 2: Understand
CO3	Apply risk assessment methodologies and analytical tools for evaluation of fire, explosion and industrial safety hazards.	Level 3: Apply
CO4	Analyze fire safety risks, accident scenarios, human reliability factors and consequences associated with industrial processes and hazardous systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Risk and Hazards: Definition, Accepted and Imposed risk, Perception and Qualification of Risk, ALARP, Cost Benefit Analysis, Fire explosion and toxic gas release, General principles of Fire Risk Assessment, Risk indices, Acceptance Criteria for Risk, As Low As Reasonably Practicable (ALARP), Risk Contour, F-N Curve, Individual Risk and Societal Risk, Hazards, Types of Hazards, Structure of Hazard Identification and Risk Assessment (HIRA), Fire Risk Scenarios, Fire Protection Measures as Fire Barriers, Hazardous Area Classification Study, Vulnerability Analysis.

Unit-II

Safety Performance: Introduction to Indian standard IS-3786, Accident,Classification of industrial accidents and special cases according to IS-3786,Theories of Accident Prevention, Principles of accident causation, Incident, Dangerous occurrence, Disabling (Lost-Time), Injury, Non-disabling injury, Reportable lost-time injury, Non-reportable lost- Time injury, Days of disablement (Lost time), Frequency rate, Weighed Frequency rate, Severity rate, Incidence rate, Frequency-severity index, Safe-T-score, Fatal accidents frequency rate.

Unit-III

Risk Assessment: Introduction, Basic Quantitative Risk Assessment (QRA), Principles of QRA, Probability Theory, Set Theory and Boolean Algebra, Use of Boolean Algebra and Cut Sets, Combination of frequencies, Logic Tree Approach, Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Qualitative risk assessment, Types of Consequences, Consequence Analysis Methodologies and Source Models, HAZOP, Conducting a HAZOP study, Computerized Reporting System, HAZOP of batch process, Extension of HAZOP, Application of HAZOP to human reliability, Failure Mode and Effects Analysis (FMEA), Methodology of FMEA, Critically Analysis, Corrective Action, Preventive Action and Follow up.

Unit-IV

Human Reliability Analysis (HRA): Factors Leading to Human Error, Characteristics of HRA Techniques, Techniques for Human Error Rate Prediction (THERP), Accident Sequence Evaluation Program (ASEP), Techniques using Expert Judgement, Operator Action Tree (OAT).

Suggested Readings:

- Fundamentals of Industrial Safety & Health- K.U.Mistry, SiddharthPrakashan.
- Industrial Safety Health and Environment management Systems by Jain and Rao, Khanna Publishers
- Safety Management- R.K. Mishra- AITBS Publishers.
- Safety Management in Industry by N.V. Krishnan, Jaico Publishing House, 1997
- Industrial Safety by Ronald P. Blake, Prentice Hall, New Delhi, 1973
- Occupational Safety and health by David L. Goetsch, Prentice Hall
- Modern Accident Investigation and Analysis by Ted S. Ferry, John Wiley & Sons
- Hazard Analysis Techniques for System by Clifton A. Erison, A John Wiley & Sons, Inc., Publication
- An Introduction to Reliability and Maintainability Engineering by Charles E. Ebeling, McGraw Hill.
- Probabilistic Risk Assessment and Management for Engineers and Scientists by Hiromitsu Kumamoto and E.J. Henley, IEEE Press.
- Quantitative Risk Assessment in Fire Safety by Ganapathy Ramachandran and David Charters, Spon Press

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Safety Engineering & Accident-Causing Mechanisms	https://youtu.be/91YpCY-1Fy0?si=9m7dc3xTVnvlrINi	NPTEL (IIT Kharagpur)
Unit-II	Safety Performance Indicators Part-I	https://youtu.be/NI89F0ISMog?si=no1jVjb6NRo52Xbl	NPTEL (IIT Kharagpur)

	Safety and Accident Loss Statistics	https://youtu.be/dlhXg7KkD0M?si=sb4EekkmyQFYBDqA	NPTEL (IIT Roorkee)
Unit-III	Fault Tree Analysis (FTA)-Construction	https://youtu.be/ZEShNJX3kcg?si=v4BPg658xrIST1kZ	NPTEL (IIT Kharagpur)
	Event Tree Analysis (ETA)	https://youtu.be/ikbC5_6qTvs?si=UV_joy0Ou7HMGV9I	NPTEL (IIT Kharagpur)
	Hazard and operability study (HAZOP)	https://youtu.be/n1s1UB80JgA?si=5E90ZscSGd1Sj7QE	NPTEL (IIT Kharagpur)
	Failure Mode Effect Analysis (FMEA)	https://youtu.be/7bFjH_ZVARI?si=_tg9BGYp1RTi9zwp	NPTEL (IIT Kharagpur)

Course Code	**PCC-FT-303A**				
Category	Professional Core Courses				
Course Title	**Fire Dynamics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make students familiar with the fundamentals of fire science, combustion phenomena and heat transfer processes involved in fire dynamics. • To provide an understanding of flame behavior, flammability characteristics and combustion mechanisms of gases, liquids and solids. • To expose students to compartment fire development, flashover phenomena and fire growth behavior in enclosed spaces. • To develop knowledge of smoke movement, smoke control principles and computational approaches used in fire dynamics analysis.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the principles of combustion, heat transfer, ignition and fire behavior associated with fire dynamics.	Level 1: Remember
CO2	Explain the characteristics of flames, burning phenomena, compartment fire development and smoke movement processes under fire conditions.	Level 2: Understand
CO3	Apply fire dynamics concepts for interpretation of combustion behavior, heat release, fire growth and smoke control mechanisms.	Level 3: Apply
CO4	Analyze the influence of combustion, ventilation, compartment conditions and smoke movement on fire development and fire safety performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fire Science and Combustion: Fire, Classification of Fire, Fire triangle, Fire tetrahedron, The Physical Chemistry of Combustion in Fire, Thermodynamics of Combustion – Stoichiometry, Thermo-chemistry, Chemical equilibrium, Thermal equilibrium, Summary of the heat transfer equations, Conduction, Convection and radiation, Pyrolysis, Ignition mechanisms.

Unit - II

Flames: Flammability, Limits of flammability, Analysis of the Structure of the reaction zone and flame temperature, Measurement and Interpretation of flammability diagram, The structure of a premixed flame, Heat losses from premixed flames, Measurement of burning velocities, Variation of burning velocity with experimental parameters, Introduction to diffusion flame, Structure of diffusion flame, Burning of condensed phases, Burning of droplet clouds, Diffusion flame height, Flame spread theory, Fire plume dynamics.

Unit-III

Burning of Liquids and Solids: Classification of liquids, Flash points and their relationship to flammability limits. The wick effect and its relevance to the ignition of high flashpoint liquid pools, Application of the flash point and fire point to the ignition of solids, Spread of flame in solid, Burning of liquids, Burning of solids, Simple thermal model for the steady burning of liquids and solids, Combustion efficiency, Ventilation-controlled fires, Heat release rate.

Unit-IV

The Pre –Flashover Compartment Fire: The growth period and the definition of flashover, Growth to flashover.
The Post- Flashover Compartment Fire: Regimes of burning, Fully-developed fire behavior, Temperatures achieved in full – developed fire, Fire resistance and fire severity, Methods of calculating fire resistance, Projection of flames from burning compartments, Spread of fire from a compartment.
Smoke Movement and Smoke Control: Smoke production, Average plume temperature, Volumetric plume flow, Hazard of smoke, Principal of smoke movement, Flow through openings, Stack effect, Influence of floor and partition, Wind effect, Smoke management, Computational tool for design.

Suggested Readings:

- Fundamental of Fire Safety in Building Design by Dr. Than Singh Sharma, Aayush Publications,2014
- NBCS-2026 (National Building Construct Code 2026)
- Fire Dynamics by Gregory Gorbett, James Pharr, Shijin Kozhurnal, 3rd Edition, 2026
- Fire Dynamics (Fire Prevention & Protection System) by Mr. MahendraPartap Singh, 2025
- Large Outdoor Fire Dynamics by Keisuke Himoto, CRC Press, 2022
- Manual of Fire Safety by N Sesha Prakash, CBS Publishers & Distributors Pvt. Ltd.
- Fire Dynamics by V.K. Jain, New Age International Publishers,2020

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Fuel and the Combustion Process	https://youtu.be/s57q7CiWrT8?si=kHUvFUW9FmsuhU6Y	NPTEL (IIT Kanpur)
	Thermodynamics of Combustion	https://youtu.be/R80x6F1kp7g?si=a4BaBwXCEt48Q0Dg	NPTEL (IIT Kanpur)
Unit-II	Limit of Flammability	https://youtu.be/Oc02lDGAVJ0?si=W5srtC60NVCKLS1Q	NPTEL (IIT Kanpur)
Unit-III	Steady Burning of Liquid and Solid Fuels	https://youtu.be/wJUU-wsJUWE?si=9hwrKDBRcoFpClYG	NPTEL (IIT Kanpur)
	Ignition of Liquids and Solids	http://elearn.psgcas.ac.in/nptel/courses/video/103107156/lec22.pdf	NPTEL (IIT Roorkee)

Unit-IV	The Pre- Flashover Compartment Fire	http://elearn.psgcas.ac.in/nptel/courses/video/105102176/105102176.html	NPTEL (IIT Delhi)
	The Post-Flashover Compartment Fire	http://elearn.psgcas.ac.in/nptel/courses/video/105102176/lec6.pdf	NPTEL (IIT Delhi)
	Description of Smoke	https://www.nptelprep.in/courses/105107213/materials	NPTEL (IIT Roorkee)
	Smoke Management	https://youtu.be/JV1yoFaB-0o?si=QEkKNUMvZYyYdrpm	NPTEL (IIT Delhi)

Course Code	**PCC-FT-305A**				
Category	Professional Core Courses				
Course Title	**Fire Safety Codes and Standards**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to national and international fire safety codes, standards and regulations used in fire protection engineering practice. • To develop understanding of standards related to fire detection, alarm systems and fixed fire protection systems for buildings and industrial occupancies. • To familiarize students with standards and specifications associated with fire extinguishers, firefighting equipment, hose systems and fire service appliances. • To provide knowledge of standards related to firefighter personal protective equipment, rescue equipment and operational safety requirements in fire service practice.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the terminology, codes, standards, and specifications related to fire safety engineering.	Level 1: Remember
CO2	Explain the requirements and provisions of fire safety codes and standards for fire protection systems, firefighting equipment, and personal protective equipment.	Level 2: Understand
CO3	Apply fire safety codes and standards for the selection, inspection, testing, and maintenance of fire protection and firefighting systems.	Level 3: Apply
CO4	Analyze the suitability and implementation of fire safety standards, firefighting equipment and protective systems in engineering and fire service applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit – I

Fire Safety Codes and Fire Detection Standards: Introduction to fire safety codes and standards, Role and significance of BIS, ISO and NFPA standards in fire safety engineering, Terminology and glossary associated with fire safety, National Building Code provisions related to fire and life safety, Fire safety signs and graphical symbols used in fire protection plans, Standards related to fire brigade control rooms and drill towers, Fire safety

requirements and Fire No Objection Certificate provisions for buildings and industrial occupancies, Standards and specifications related to fire detection and alarm systems, Heat, Smoke, Flame and gas detectors, VESDA systems, Notification appliances, Interconnections and integration of fire alarm systems, Standards related to sprinkler systems and fixed fire protection systems, Interpretation and application of fire safety standards in engineering practice.

Relevant Standards: IS 8757, IS 957, IS 5888, IS 12349, IS 12407, IS 15394, IS 18006, IS 2189, IS/ISO 7240 Series, IS 15908, IS 9972, IS 15105, IS 16088, IS 16534 and relevant NFPA Standards.

Unit – II

Standards for Fire Extinguishers and Extinguishing Media: Classification and specification of portable and fixed fire extinguishers, Standards related to extinguishing agents including water, Foam, Dry chemical powder and carbon dioxide, Installation, Inspection, Testing and maintenance requirements of extinguishers, Performance and safety requirements of extinguishers and extinguishing media, Operational requirements and marking systems for extinguishers and extinguishing agents, Interpretation and application of standards related to fire extinguishers and extinguishing systems in fire safety engineering practice.

Relevant Standards: IS 2190, IS 4152, IS 4308, IS 4862 Part 1, IS 4947, IS 4989, IS 11108, IS 11833, IS 12835 Part 1, IS 14951, IS 15220, IS 15221, IS 15222, IS 15493, IS 15496, IS 15497, IS 15501, IS 15505, IS 15506, IS 15517, IS 15519, IS 15525, IS 15528, IS 15683, IS 15835, IS 16018, IS 19452 and relevant NFPA Standards.

Unit – III

Standards for Fire Hose Systems, Pumps and Fire Service Appliances: Standards and specifications related to fire hoses, Hose fittings, Couplings, Branches, Nozzles and delivery equipment, Performance requirements of fire hose systems and accessories, Inspection, Testing and maintenance requirements of hose systems and fittings, Classification, Specification and operational requirements of fire pumps, Fire tenders and fire service appliances, Pump performance standards, Testing and operational standards for firefighting vehicles and fire service equipment, Interpretation and application of standards related to firefighting equipment and fire service operations.

Relevant Standards: IS 636, IS 884, IS 2930, IS 3844, IS 8423, IS 14851, IS 14933, IS 15051, IS 901–909, IS 937, IS 952, IS 2871, IS 3582, IS 4643, IS 5131, IS 5612 Part 1 & 2, IS 5714, IS 8090, IS 8442, IS 9668, IS 11101, IS 942, IS 943, IS 944, IS 947, IS 948, IS 950, IS 951, IS 955, IS 5896 Part 1, IS 6067, IS 6070, IS 10460, IS 10993, IS 12469, IS 12717, IS 15301 and relevant NFPA Standards.

Unit – IV

Standards for Personal Protective Equipment and Rescue Equipment: Standards related to firefighter personal protective equipment, Protective clothing, Helmets, Gloves, Boots and respiratory protection equipment, Standards related to self-contained breathing apparatus and firefighter safety equipment, Specification and performance requirements of firefighter protective systems, Standards related to rescue equipment, Ropes, Ladders and small firefighting gear, Inspection, Testing and maintenance requirements of rescue and firefighting equipment, Interpretation and application of PPE and rescue equipment standards in fire service practice.

Relevant Standards: IS 2745, IS 4355, IS 9995, IS 15381, IS 16874, IS 16890, IS 18582 Part 6, IS 18589 Part 3, 4 & 6, IS 18804, IS 19198, IS 926, IS 927, IS 928, IS 8096, IS 12796, IS 12859, IS 12861, IS 12862, IS 939, IS 4571, IS 5896 Part 3, NFPA 1983 and NFPA 1932.

Suggested Readings:

- Relevant Indian Standards (IS codes)
- Relevant NFPA standards

Course Code	**ESC-ME-307A**				
Category	Engineering Science Courses				
Course Title	**Strength of Materials**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the concepts of force systems, equilibrium conditions and analysis of engineering structures. • To develop understanding of stresses, strains and mechanical behavior of materials under different loading conditions. • To familiarize students with the principles of truss analysis, moment of inertia, shear force and bending moment in structural members. • To provide knowledge of bending stresses, beam deflection and pressure vessel behavior along with associated safety considerations.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts of force systems, equilibrium, stresses, strains and structural behavior of engineering materials and members.	Level 1: Remember
CO2	Explain the concepts of force, behavior of trusses, beams and pressure vessels under different loading and support conditions.	Level 2: Understand
CO3	Apply the laws, principles of force, stress analysis, moment of inertia, shear force, bending moment, beam bending and deflection for solving engineering problems.	Level 3: Apply
CO4	Analyze the force system, structural response, bending behavior and safety aspects of beams, trusses and pressure vessels subjected to different loading conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Force and its effects: Units and measurement of force, Characteristics of force vector representation, Bow's notation, Types of forces, action and reaction, tension & thrust.

Force Systems: Coplanar and space force systems, Coplanar, concurrent and non -concurrent forces, Free body diagrams, Resultant and components of forces, concept of equilibrium, parallelogram law of forces,

Equilibrium of two forces, super-position and transmissibility of forces, Newton's third law, triangle law of forces, parallelogram law, Lami's theorem.

Unit-II

Simple Stresses & Strains: Introduction, types of stresses and strains, Poisson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading, Numericals.

Trusses and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Numericals.

Unit-III

Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, problem based on composite figures and solid objects, centroid and center of gravity, Numericals.

Shear Force & Bending Moments: Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contra-flexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, Numericals.

Unit-IV

Bending Stresses in Beams: Theory of bending, Flexural formula, Moment of resistance and section modulus, Bending of symmetrical sections.

Deflection of beams: Slope and deflection concept, Differential equation of elastic curve, slope and deflection in different type of beams.

Pressure Vessels: Introduction, Classification of pressure vessels, materials used, Stresses in pressure vessels, Hazards associated with pressure vessels, Safety devices, Inspection and testing, Fire protection systems for pressure vessels.

Suggested Readings:

- Strength of Materials by Sadhu Singh, Dhanpat Rai Publishing Company, New Delhi
- Strength of Materials by G. H. Ryder, Macmillan, India
- Mechanics of Materials by R. C. Hibbeler, Cengage Learning India Pvt. Ltd., New Delhi
- Strength of Materials by R.K. Rajput, S. Chand Publication, New Delhi
- Engineering Mechanics by Irving H. Shames, PHI Publication, New Jersy
- Engineering Mechanics by Dr. D. S. Kumar, Kataria& Sons, New Delhi
- Strength of Materials by S. Ramamrutham, Dhanpat Rai Publishing Company, New Delhi

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Introduction to Forces	https://www.youtube.com/watch?v=YXuGB2Fd4Eg	NPTEL(IIT Madras)
	Force System-I	https://nptel.ac.in/courses/112106286	NPTEL(IIT Madras)
	Force System-II	https://nptel.ac.in/courses/112106286?utm	NPTEL(IIT Madras)
	Equilibrium of rigid bodies	https://www.youtube.com/watch?v=g2Vwjk-rAuM&list=PLq7jO-L_k0yUk2tfPwhea9asGRBXcUEpL&index=11	NPTEL(IIT Kanpur)
Unit-II	Basic Introduction of Stresses	https://nptel.ac.in/courses/112106319	NPTEL(IIT Madras)
	Analysis of Strain	https://www.youtube.com/watch?v=iJTHPgYAqvQ&list=PL27C4A6AEA552F9E6&index=7	NPTEL(IIT Kharagpur)
	Truss	https://nptel.ac.in/courses/122104015	NPTEL(IIT Kanpur)
	Truss – Method of Joints	https://www.youtube.com/watch?v=GKLEysulS08&list=PLLy_2iUCG87AgdE8-bSTgt-Id4lhzWf7p&index=17	NPTEL(IIT Roorkee)
	Truss – Method of Sections	https://www.youtube.com/watch?v=NlBjOIwfKhE&list=PLLy_2iUCG87AgdE8-bSTgt-Id4lhzWf7p&index=18	NPTEL(IIT Roorkee)
Unit-III	Friction	https://nptel.ac.in/courses/112107539	NPTEL(IIT Roorkee)
	Moment of Inertia	https://nptel.ac.in/courses/112107539	NPTEL(IIT Roorkee)
	Moments and Product of Inertia	https://www.youtube.com/watch?v=ZwuwzE1qAi4	NPTEL(IIT Delhi)
	Shear Force and Bending Moment	https://nptel.ac.in/courses/112107146	NPTEL(IIT Roorkee)
Unit-IV	Bending Stress in Beams	https://nptel.ac.in/courses/105105108	NPTEL(IIT Kharagpur)
	Deflection of Beams	https://nptel.ac.in/courses/105105108	NPTEL(IIT Kharagpur)
	Column Buckling Theory	https://www.youtube.com/watch?v=q6WPVDgiWjQ	NPTEL(IIT Guwahati)
	Pressure Vessels	https://www.youtube.com/watch?v=aI-oyoaiCpU	NPTEL(IIT Madras)

<table>
<tr><td>Course Code</td><td colspan="5">PCC-FT-309A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Fire Protection</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of the principles, components and operation of fire detection, alarm and notification systems used in fire protection engineering.
To develop understanding of water-based, water spray, water mist and foam fire suppression systems and their applications in different occupancies and hazards.
To familiarize students with gaseous, chemical and industrial fire protection systems, explosion protection methods and associated safety considerations.
To enable students to learn inspection, testing, maintenance and design considerations of various fire protection systems in accordance with standard engineering practices and codes.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the principles, components, and terminology of fire detection, alarm, and fire protection systems used in fire and safety engineering.	Level 1: Remember
CO2	Explain the working principles, design concepts, and applications of fire detection, water-based, foam, gaseous, and chemical fire protection systems.	Level 2: Understand
CO3	Apply the principles of fire detection and fire protection systems to select appropriate fire safety measures for buildings and industrial occupancies.	Level 3: Apply
CO4	Analyze the performance of fire protection systems and industrial fire and explosion hazards to recommend suitable fire protection strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit – I

Fire Detection and Alarm Systems: Active and passive fire protection systems, components of fire detection and alarm systems, heat, smoke, flame and gas detectors, VESDA systems, notification appliances, detector selection and spacing concepts, false alarm management, interconnections and integration, gas and vapor

detection systems, electrochemical sensors, inspection, testing and maintenance of fire detection and alarm systems.

Unit – II

Water-Based Fire Protection Systems: Extinguishing mechanism and limitations of water, automatic sprinkler systems, principles and types of sprinkler systems, sprinkler heads and classification, k-factor, deluge systems, water supply requirements as per NBC, fire pumps and pump house arrangements, terrace tanks and terrace pumps, overview of fire pump sizing concepts, Standpipe and hose systems, wet risers, internal and external hydrants, zoning in standpipe systems, hose reels, inspection, testing and maintenance of water-based fire protection systems.

Unit – III

Water Spray, Water Mist and Foam Systems: Water spray systems, components and applications, ultra-high-speed water spray systems, methods of extinguishment, response time and design considerations, water mist systems, methods of generating water mist, mist classification, spray characteristics, applications and limitations, Firefighting foams, types and properties of foam concentrates, extinguishing mechanism and limitations of foam, expansion ratio, low, medium and high expansion foam systems, foam generating equipment, foam protection systems for storage tanks and industrial hazards, foam application concepts.

Unit – IV

Gaseous, Chemical and Industrial Fire Protection Systems: Carbon dioxide fire suppression systems, extinguishing mechanism and limitations of CO_2, total flooding and local application systems, components and safety precautions, Clean agent fire suppression systems, inert gas and synthetic agents, extinguishing mechanisms, design concentration concepts, pressure relief vents, applications and limitations, Dry chemical powder, aerosol and wet chemical extinguishing systems, extinguishing mechanisms, applications and maintenance, overview of agent quantity calculations, Industrial fire and explosion hazards, Explosion prevention and protection systems, deflagration venting and explosion suppression systems, fire protection considerations in industrial occupancies.

Suggested Readings:

- Industrial Safety, Health & Environment Management System by R.K. Jain & Sunil S. Rao, Khanna Publishers.
- Fire Safety in Buildings by V.K. Jain, New Age International Publishers.
- Fire Protection and Prevention: The Essential Handbook Volume 1 & 2 by B.M. Sen, UBS Publishers.
- Principles of Fire Safety Engineering: Understanding Fire and Fire Protection byAkhil Kumar Das, PHI Learning Private Limited (Prentice Hall India).
- Industrial Safety and Health Management by C. Ray Asfahl and David W. Rieske, Pearson India
- Relevant IS Standards.
- SFPE Handbook of Fire Protection Engineering by Morgan J. Hurley, Society of Fire Protection Engineers (SFPE) / Springer.
- Relevant NFPA Standards.

Course Code	**LC-FT-311A**				
Category	Professional Core Courses				
Course Title	**Fire Dynamics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To provide practical exposure to the ignition, combustion and burning characteristics of gaseous, liquid and solid fuels. • To develop experimental understanding of flame behavior, flame spread and fire growth phenomena under different fire conditions. • To familiarize students with measurement techniques for burning rate, heat release rate, smoke production and toxic gas emissions in fire experiments. • To enable students to study the influence of ventilation and compartment conditions on smoke movement and compartment fire dynamics.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the ignition characteristics, and flame behavior of combustible solids, liquid fuels and gas-air mixtures through laboratory experiments.	Level 2: Understand
CO2	Apply experimental methods to determine flash point, fire point, flame spread, flame height, burning rate and mass loss characteristics of combustible materials during combustion.	Level 3: Apply
CO3	Apply fire testing techniques to measure heat release rate, smoke production and toxic gas emissions of combustible materials.	Level 3: Apply
CO4	Analyze the effect of compartment conditions and ventilation on smoke movement, smoke stratification and compartment fire growth behavior.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**
1	To determine the flash point and fire point of liquid fuels using Pensky-Martens Closed Cup and Cleveland Open Cup apparatus.
2	To study the ignition behavior of combustible solids under radiant heat exposure.
3	To study the ignition behavior of liquid fuels under radiant heat exposure.
4	To determine the burning velocity of gas-air mixtures using cone angle method.
5	To study the characteristics of premixed and diffusion flames.

6	To determine the flame spread rate over solid combustible surfaces.
7	To determine the flame height and burning rate of liquid pool fires.
8	To determine the burning rate and mass loss rate of solid fuels during combustion.
9	To measure the heat release rate of combustible materials using cone calorimeter.
10	To measure smoke production and toxic gas emissions during combustion.
11	To study smoke layer formation and smoke stratification in compartment fires.
12	To study the effect of ventilation on compartment fire growth and smoke movement.

Note: At least 8 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course Code	**LC-ME-313A**				
Category	Engineering Science Courses				
Course Title	**Strength of Materials Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To familiarize the students with the operation and applications of material testing machines and equipment used in strength of materials laboratory experiments. • To develop the understanding of students regarding the mechanical behavior and strength characteristics of engineering materials under different loading conditions. • To enable the students to perform experimental determination of shear force, bending moment, hardness, impact strength, mechanical advantage, and efficiency of engineering systems. • To make the students learn the analysis and evaluation of experimental results related to material properties and structural behavior.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Apply the principles of shear force and bending moment for drawing shear force and bending moment diagrams of simply supported beams under different loading conditions.	Level 3: Apply
CO2	Apply standard testing procedures for conducting tensile, compression, bending, and shear tests on engineering materials using the Universal Testing Machine (UTM).	Level 3: Apply
CO3	Analyze the mechanical behavior and strength characteristics of engineering materials under tensile, compressive, bending, shear, and impact loading conditions using experimental observations and test data.	Level 4: Analyze
CO4	Analyze the hardness characteristics and surface resistance of engineering materials using Brinell, Rockwell, and Vickers hardness testing methods.	Level 4: Analyze
CO5	Evaluate the mechanical advantage, efficiency, and performance characteristics of winch crabs and screw jacks through experimental testing and calculations.	Level 5: Evaluate

List of Experiments

Sr. No.	**Contents**
1	To draw shear force and bending moment diagrams for simply supported beams subjected to point loads and distributed loads.
2	To study the Universal Testing Machine (UTM) and perform tensile tests on engineering materials.

3	To perform compression and bending tests using the Universal Testing Machine (UTM).
4	To perform shear tests on engineering materials using the Universal Testing Machine (UTM).
5	To study the impact testing machine and perform Izod and Charpy impact tests.
6	To study the Brinell hardness testing machine and perform the Brinell hardness test.
7	To study the Rockwell hardness testing machine and perform the Rockwell hardness test.
8	To study the Vickers hardness testing machine and perform the Vickers hardness test.
9	To determine the mechanical advantage and efficiency of single purchase and double purchase winch crabs.
10	To determine the mechanical advantage and efficiency of simple and compound screw jacks.

Note: At least 8 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

<table>
<tr><td>Course Code</td><td colspan="5">LC-FT-315A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Fire Ground Operations-V</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To develop the understanding of students regarding ropes, ladders, hoses, pumps, water relay systems, and water tenders used in firefighting operations.
● To familiarize the students with testing procedures, operational methods, and maintenance practices of firefighting equipment and accessories.
● To make the students learn firefighting drills, foam generation techniques, pumping operations, and salvage procedures used during fire emergencies.
● To develop the practical skills of students in handling firefighting equipment, conducting operational tests, and performing coordinated firefighting and rescue drills.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the construction, types, operational features, testing methods, and applications of ropes, ladders, hoses, pumps, water relay systems, and water tenders used in firefighting operations.	Level 2: Understand
CO2	Perform rolling, testing, operational handling, and maintenance procedures of ropes, ladders, hoses, pumps, and firefighting equipment during practical firefighting exercises.	Level 3: Apply
CO3	Demonstrate foam drills, extinguisher drills, pumping drills, water relay operations, and salvage procedures using firefighting appliances and foam-making equipment.	Level 3: Apply
CO4	Analyze the operational performance, testing results, and functional suitability of firefighting equipment, pumping systems, and relay operations under different firefighting conditions.	Level 4: Analyze

List of Experiments

Sr. No.	Contents
1	To study and perform rolling of Ropes.
2	To study and perform testing of Ropes.
3	To study different types of Ladders and their parts.
4	To study and perform rolling of Hoses.
5	To perform different ladder test

	(a) Round test (b) String test (c) Extension line test
6	To perform Hose tests (a) Suction hose test (b) Delivery hose test (c) Hose reel hose test
7	To study and perform extinguisher drill.
8	To study and perform the drill using Foam making equipment: (a) FB-2 with (Knap Sack Tank) (b) FB-5X (c) FB- 10X (d) FB-20 (e) FM Generator (f) Inline inductor (g) Foam Monitor
9	To perform foam drill with foam test.
10	To perform four men pump drill with pump test.
11	To perform six men pump drill with pump test.
12	To perform close water pumping drill.
13	To perform open water pumping drill.
14	Salvage: (a) Types of Salvage sheet (b) Salvage before fire (c) Salvage during fire (d) Salvage after fire
15	Pump: (a) Bucket pump (b) Portable pump (c) Trailer pump
16	Test: (a) Pump output test (b) Vacuum test (c) Suction test
17	Water Relay: (a) Types of water relay (b) Close relay (c) Open relay (d) Uses of Portable dam
18	Types of Water tender: (a) Type A (b) Type B (c) Type X

Other drills and tests can be performed as decided by department (time to time) depending upon the scope of course.

Course code	**INT-FT-317A**				
Category	Seminar/Internship				
Course Title	**Industrial Seminar -I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are • To make the students familiar with industrial practices, fire safety systems, emergency response procedures, and safety management activities followed in industries, fire academies, and related organizations. • To develop the understanding of students regarding practical applications of fire protection engineering, industrial safety practices, firefighting operations, and hazard control measures in real working environments. • To familiarize the students with professional work culture, technical documentation, safety regulations, reporting procedures, and operational responsibilities in industries and fire service organizations. • To make the students learn practical problem-solving approaches, communication skills, technical report writing, seminar presentation, and professional ethics through industrial training exposure. .				
Assessment	50 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Assessment of Industrial Seminar–I shall be based on the case study, seminar presentation, viva-voce, training report, and certificate of practical training undergone by the student at the end of the IV Semester from an Industry/Institute/Professional Organization/Research Laboratory/Training Centre/Software Organization, with the prior approval of the Director of the Institute/Head of the Department.

Course Outcomes: After successful completion of this course, the students will be able to

CO	**Skill Demonstrated**	**Level**
CO1	Describe the organizational structure, fire safety systems, industrial operations, emergency response procedures, and safety practices followed in industries and fire service organizations.	Level 1: Remember
CO2	Explain the working principles, operational procedures, safety regulations, and fire protection practices observed during industrial training.	Level 2: Understand
CO3	Apply fire safety practices, operational procedures, safety rules, and technical knowledge for performing assigned activities during industrial training.	Level 3: Apply
CO4	Analyze industrial operations, fire hazards, emergency response systems, and safety management practices based on observations and training experience.	Level 4: Analyze
CO5	Evaluate the effectiveness of fire protection measures, industrial safety practices, emergency preparedness systems, and operational procedures followed in the organization.	Level 5: Evaluate
CO6	Prepare and present a comprehensive industrial training report and seminar based on practical learning, observations, technical findings, and professional experience gained during training.	Level 6: Create

Course Code	**MC-301A**				
Category	Mandatory Non Credit Courses – Audit Courses				
Course Title	**Essence of Indian Traditional Knowledge**				
Scheme and Credits	L	T	P	**Credits**	**Semester -V**
	2	0	0	-	
Course Objectives	The objectives of this course are • To make the students familiar with the fundamentals, structure, and components of the Indian Knowledge System including Vedas, Upavedas, Vedangas and Upangas. • To develop the understanding of students regarding the relationship between modern science and the Indian Knowledge System. • To familiarize the students with the principles of yoga, holistic healthcare, and their significance in physical and mental well-being. • To make the students learn the practical relevance and applications of the Indian Knowledge System through case studies and interdisciplinary approaches.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the concepts related to the Indian Knowledge System, Vedas, Upavedas, Vedangas, Upangas, yoga and holistic healthcare.	Level 1: Remember
CO2	Explain the structure, principles, and interdisciplinary relevance of the Indian Knowledge System in relation to modern science and healthcare practices.	Level 2: Understand
CO3	Apply the concepts of yoga, holistic healthcare, and Indian Knowledge traditions for promoting well-being and understanding their practical significance in contemporary society.	Level 3: Apply
CO4	Analyze the contributions and applications of the Indian Knowledge System in science, healthcare, education, and societal development through case studies and interdisciplinary perspectives.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Contents

- Basic Structure of Indian Knowledge System: Ashtadasha Vidya (Eighteen Branches of Knowledge in the Indian Knowledge System), Veda, Upaveda (Ayurveda, Dhanurveda, Gandharvaveda, Sthapatyaveda etc.), Vedanga (Shiksha, Kalpa, Nirukta, Vyakarana, Jyotisha, Chhanda), Upanga (Dharmashastra, Mimansa, Purana, Tarkashastra).
- Modern Science and Indian Knowledge System.
- Yoga and Holistic Healthcare.
- Case Studies.

Suggested Readings:

- Cultural Heritage of India – Course Materials by V. Sivaramakrishnan, Bharatiya Vidya Bhavan, Mumbai
- Modern Physics and Vedant by Swami Jitatmanand, Bharatiya VidyaBhavan
- Holistic Science and Vedant by Swami Jitatmanand, Bharatiya VidyaBhavan
- Tarkasangraha of Annam Bhatta by V. N. Jha (English Translation), International Chinmaya Foundation, Veliyanad, Ernakulam
- Yoga Sutra of Patanjali by Ramakrishna Mission, Kolkata
- Yoga-Darshanam with Vyasa Bhashya by G. N. Jha (English Translation), Edited by R. N. Jha, Vidyanidhi Prakashan, Delhi
- Science of Consciousness, Psychotherapy and Yoga Practices by R. N. Jha, VidyanidhiPrakashan, Delhi
- Shodashang Hridayam by P. B. Sharma (English Translation)

<table>
<tr><td>Course Code</td><td colspan="5">PEC-FT-319A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Electives Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Special Fire Hazards</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To provide knowledge of fire hazards, emergency response procedures and preventive measures associated with transportation and railway systems.
• To develop understanding of marine, port and aviation fire safety systems, rescue operations and firefighting strategies.
• To familiarize students with fire and explosion hazards in industrial occupancies, high-rise buildings and specialized hazardous environments.
• To acquaint students with fire safety management, evacuation strategies, firefighting challenges and safety measures related to complex infrastructures and nuclear facilities.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fire hazards, safety features, emergency response procedures and preventive measures associated with transportation, marine, aviation, industrial and building fire safety systems.	Level 1: Remember
CO2	Explain the fire protection systems, firefighting operations, evacuation procedures and safety management practices used in different hazardous occupancies and infrastructures.	Level 2: Understand
CO3	Apply fire safety principles and emergency response concepts for management of fire and explosion hazards in transportation, industrial, marine, aviation and high-rise building environments.	Level 3: Apply
CO4	Analyze fire risk scenarios, operational challenges and mitigation strategies associated with complex fire emergencies and hazardous installations.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Transportation Safety: Fundamentals of transportation fire safety, Passenger and commercial vehicle fires, Hazardous material transportation, MSDS, HAZCHEM code, Placards and TREM cards, LNG/LPG transportation hazards, Electric vehicle and lithium-ion battery fire hazards, Emergency response procedures, Preventive measures and case studies.

Trains Safety: Structural features of trains, Railway stations, Tunnels and metro rail systems, Railway fire hazards, passenger evacuation, Tunnel fire safety, Rescue operations, Emergency response strategies and case studies.

Unit-II

Marine and Port Fire Safety: The maritime environment, Types of vessels, Constructional features of passenger and cargo ships, Fire detection and suppression systems in ships, Cargo hazards and safety measures, Marine firefighting and rescue operations, Emergency planning, Preventive measures and strategic management**,** Fire protection facilities for ports handling hydrocarbons as per OISD-STD-156, Ships and marine technology fire extinguishing systems for protection of galley cooking equipment as per IS 17564,Ships and Marine technology windows and side scuttles for fire-resistant constructions as per IS 18280,Shipbuilding testing, Installation and maintenance of marine portable fire appliances- Code of practice as per IS3947, Loading and unloading hazards, Firefighting systems in ports and terminals, Emergency response systems, Preventive measures and case studies.

Unit-III

Aviation Fire Safety: Constructional features of aircraft, Aircraft fire hazards, Air crashes and emergency landings, Rescue operations in aircraft fires, Airport fire hazards, Hangar protection systems, Crash fire tenders and rapid intervention vehicles, Airport categorization and firefighting appliances as per international standards and case studies.

Industrial and High-Rise Fire Safety: Fire safety in iron and steel industries, Petroleum refineries, Fertilizer plants, Pharmaceutical industries, Coal-based industries and thermal power plants, Hydrogen hazards, BLEVE, Vapor cloud explosions, Rocket propellants, Industrial emergency response procedures, Preventive measures and case studies.

Unit-IV

Building Fire Safety: Fundamentals of fire-safe building design, Life safety systems for high-rise buildings, Structural fire protection, Alarm and signaling systems, Smoke movement and smoke control systems, Refuge areas, Fire lifts, Façade fire hazards, Evacuation strategies, Firefighting challenges in high-rise buildings and case studies**.**

Nuclear Safety: Radiation and its types, Nuclear reactors, Radiation emergencies, Firefighting and rescue operations in radiation hazard areas, Radiation safety measures, Radioactive waste management, Nuclear accidents, Mitigation measures and strategic management.

Suggested Readings:

- Radioactive Materials by B.M. Rao, Himalaya Publishing House.
- Fire Safety in Buildings by V K Jain, New Age Publishers, New Delhi.
- Indian Buildings Congress Manual of Fire Safety in Buildings by Indian Building Congress, Nabhi Publication
- Industrial Safety, Health and Environment Management Systems by R. K. Jain and Sunil S. Rao,Khanna Publishers

- Handbook on Fire and Life Safety in Buildings by Barendra Mohan Sen, Techno World
- Airport, Aircraft and Aviation Fire Safety by P. K. Sarkar,S. K. Kataria and Sons
- Marine Fire Prevention, Firefighting and Fire Safety by D. K. Gupta,CBS Publishers and Distributors
- OISD-STD-156

Course Code	**PEC-FT-321A**				
Category	Professional Elective Courses				
Course Title	**Offshore Structures under Special Environmental Loads including Fire Resistance**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce students to offshore structures, environmental loading conditions and hydrodynamic effects associated with offshore engineering systems. ● To develop understanding of structural behavior, stress analysis and dynamic response of offshore structural members and riser systems. ● To familiarize students with offshore fire hazards, fire development behavior and fire protection systems used in offshore installations. ● To provide knowledge of structural design methodologies and material behavior of steel, concrete and composite members under fire conditions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the terminology related to offshore structures, environmental loading, structural behavior, and fire safety engineering.	Level 1: Remember
CO2	Explain the principles of offshore structural systems, environmental loading, structural response, fire safety, and structural behavior under fire.	Level 2: Understand
CO3	Apply the principles of offshore structural analysis, fire safety, and structural fire design to offshore engineering applications.	Level 3: Apply
CO4	Analyze the structural performance and fire safety of offshore structures under environmental and fire loading conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit–I

Offshore Structures and Environmental Loading: Introduction to offshore structures, Classification and novelty of offshore platforms, Fixed platforms, Compliant platforms, Guyed towers, Articulated towers, Tension leg platforms (TLP), SPAR platforms, Semisubmersibles, Floating production storage and offloading systems (FPSO), Jack-up rigs, Drill ships, Buoyant leg structures (BLS), Triceratops and regasification platforms. Environmental loading on offshore structures, Wave loads, Airy wave theory, Wheeler's and Chakrabarti's modifications, Random waves and wave spectra, Pierson–Moskowitz spectrum, ISSC spectrum, JONSWAP spectrum, Wind loads and wind spectra, Current loads, Ice loads, Seismic loads, Springing and ringing effects, Blast loads and fire loads.

Unit–II

Structural Behavior and Dynamic Response of Offshore Structures: Unsymmetrical bending, Shear center, Curved beams with small and large initial curvature, Stress analysis in curved beams, Circular, Rectangular, Triangular, Trapezoidal, T and I sections, Simplified stress estimation methods, Marine risers and offshore structural components, Low-pressure risers, High-pressure drilling risers, Flexible risers, Top tensioned risers (TTR), Vortex-induced vibration (VIV), Dynamic response of offshore structural members, Hydrodynamic effects on offshore structures, Fatigue behavior of offshore components, VIV suppression systems and research case studies.

Unit–III

Fire Safety in Offshore Structures: Introduction to offshore fire safety, Fire and explosion characteristics in offshore platforms, Classification of fire, Pool fire, Jet fire, Flash fire and fireball, Minimum ignition energy, Fire risk assessment, Fire scenarios in offshore installations, Causes of offshore fire accidents and lessons learned, Fire development and behavior, Combustion characteristics of materials, Ignition and spread of fire, Open fires, Compartment fires, T-squared fire model, Pre-flashover, Flashover and post-flashover behavior, Fire protection systems in offshore structures, Active and passive fire protection systems, Fire detection and alarm systems, Firefighting equipment, Compartmentation, Fire-resistant construction, Egress and human behavior during emergencies, Offshore evacuation systems, Fire resistance and equivalent fire severity, Fire resistance testing methods and fire-resistance ratings.

Unit–IV

Structural Design under Fire: Material behavior at elevated temperatures, Thermal properties of steel and concrete, Specific heat, density, Thermal conductivity and thermal diffusivity, Mechanical properties and constitutive models of steel and concrete under fire conditions, Temperature assessment methods for structural members, Eurocode approach, Fire rating methods, Bare and protected steel sections, Strength assessment of steel members under fire, Design of concrete members under fire, Temperature analysis methods, Wickstrom's method, Hertz's method, 500°C isotherm method and zone method, Composite structures under fire, Composite beams and columns, Critical temperature approach, Moment capacity approach, Numerical examples on steel, Concrete and composite structural members exposed to fire.

Suggested Readings:

- Design Aids of Offshore Structures Under Special Environmental Loads Including Fire Resistance by Srinivasan Chandrasekaran and Gaurav Srivastava.
- Dynamics of Offshore Structures by James F. Wilson.
- Offshore Structures: Design, Construction and Maintenance by Mohammad H. El-Reedy.
- Design of Offshore Concrete Structures by M. S. Troitsky.
- Structural Fire Engineering by VenkateshKodur.
- Fire Safety Engineering Design of Structures by John A. Purkiss.
- Offshore Engineering: An Introduction by Srinivasan Chandrasekaran.
- Handbook of Offshore Engineering by SubrataChakrabarti.
- Environmental Engineering and Management by Suresh K. Dhameja, S.K. Kataria& Sons.
- Environmental Impact Assessment: Methodologies by Y. Anjaneyulu and ValliManickam, B.S. Publications.
- Industrial Safety and Environment by Amit Gupta, University Science Press.
- Industrial Safety and Environment by A. Prashar, P.Bansal, Kataria Press.
- Process Safety Management and Risk Hazard Analysis by Srinivasan Chandrasekaran, CRC Press.
- Fire and Explosion Protection Engineering Principles by Dennis P. Nolan, CRC Press.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Introduction of offshore structures	https://youtu.be/pyvR3uN1nRQ	NPTEL (IIT Madras)
	Fixed offshore platform	https://youtu.be/Q4ptPBcKtiM	NPTEL (IIT Madras)
	Wave load on off shore structure	https://youtu.be/r7XVuxkTi80	NPTEL (IIT Madras)
Unit-II	Dynamics of offshore structures	https://nptel.ac.in/courses/114106038?utm	NPTEL (IIT Madras)
	Shear center	https://youtu.be/UexSV-vDS98	NPTEL (IIT Madras)
Unit-III	Offshore fire safety	https://youtu.be/n6HAyxdup_U	NPTEL (IIT Delhi)
Unit-IV	Fire resistance steel	https://youtu.be/uOegFI_jNEc	NPTEL (IIT Delhi)

Course Code	**PEC-FT-323A**				
Category	Professional Elective Courses				
Course Title	**Fire Service Communication and Mobilizing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the organization, layout and operational requirements of fire service control rooms, watch rooms and fire stations. • To develop understanding of the roles, responsibilities and communication procedures associated with fire service personnel and emergency response systems. • To familiarize students with equipment, signaling systems and call handling arrangements used in fire control and mobilization systems. • To provide knowledge of testing procedures, standby arrangements and radio communication systems used in fire service operations.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the terminology related to fire service organization, communication systems, emergency call handling, and wireless communication.	Level 1: Remember
CO2	Explain the principles of fire service control rooms, communication systems, call handling procedures, and wireless communication.	Level 2: Understand
CO3	Apply fire service communication, mobilization, and emergency response procedures for effective fire service operations.	Level 3: Apply
CO4	Analyze fire service communication systems and operational procedures to improve emergency response efficiency.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fire Service Control Room and Watch Room: Introduction, Control rooms, General requirements and considerations-. General requirements, Centralization problems, Administrative system implications, Safeguard against breakdown, Watch rooms, The station ground, The turn out area, The telephone call area.

Roles and Responsibilities of Fire Personnel: Introduction to the fire department, Roles and responsibilities of fire personnel.

Unit-II

Equipment In Control Room, Watch Room, and Fire Stations: Automatic fire alarm system terminations, Fire telephone, Running call facilities, Enquiry bell, Station bells, Firemen's call bell systems, Public address system, Tele printer, Turn out lighting, Alternative lighting, Control of traffic light, Automatic appliance starter, Appliance room door control, Exchange telephone lines and switchboards, Key and lamp units, Private telephone circuit, Priority signaling facilities, Appliance turn out indicator lights, Radio apparatus, Clock and calendar, Tape recorder, Control room consoles, Maps and diagrams, Availability and fire situation displays, Records – log book, occurrence book, First attendance and other mobilizing data, Route and special risk cards, General information, Microfilm systems.

Unit-III

Fire Call Handling Procedures: General principles calls by exchange telephone, Running calls, Fire telephones and other private circuits, Automatic fire detection system, Calls received from various radio systems, Part time station arrangements, Salutations.

Call-Out Systems: Firemen's call bell system, Fire sirens – siren installations, Maintenance and testing, War emergency use, Radio pocket alerting system – General description, The transmitter, The pocket alerter, The home battery charger, Alerter transmitter battery chargers, Public address call out systems, Methods of controlling call out systems – Local control, Remote control.

Unit-IV

Testing, Fault Reporting and Alternative Arrangements: Testing arrangements, Fault reporting and alternative arrangements, Fusing and identification of electrical circuits, Standby power arrangements.

Radios And Wireless Communication: Frequency spectrum, Characteristics, Selection, and Allocation, Types of radio scheme, Mobile radio equipment, Transportable and personal sets, Personal paging system, "figaro" low frequency communication systems, Hazards attending the use of radio equipment in flammable atmosphere or in the vicinity of explosives.

Suggested Readings:

- Manual of Firemanship.
- HMSO Fire Service Manual Fire Service Communication and Mobilizing (Volume 1).
- Relevant NFPA Manual and IS code

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Introduction Fire Service Control Room	https://youtu.be/8QIny3MFXzI?si=D83353CbM6-IVS_g	NPTEL (IIT Delhi)
Unit-II	Records in Fire Stations	https://youtu.be/mKecK1byRk8?si=iMHbRqtRg3KuRNgf	NPTEL (IIT Delhi)
Unit-III	Fire call Handling Procedures	https://youtu.be/9_LvrgKEnCM?si=1QuHdL23oFJY93ht	NPTEL (IIT Delhi)
Unit-IV	Testing, Fault Reporting	https://youtu.be/TNCyIw9JC6k?si=G4zml-7wtVBZS4CT	NPTEL (IIT Hy.)
	Radios and Wireless Communication	https://youtu.be/F3slBe2r8vA?si=1Oo7YJ4Fww4I6h0K	NPTEL (IIT Kanpur)

Course Code	**PEC-FT-325A**				
Category	Professional Elective Courses				
Course Title	**Fire and Life Safety Audit**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the principles, procedures and statutory requirements associated with fire and life safety audits. • To develop understanding of audit standards, quality assurance systems and documentation practices used in fire safety management. • To familiarize students with fire safety planning, organizational responsibilities and emergency management practices in industrial and commercial occupancies. • To provide knowledge of evaluation, monitoring and continual improvement techniques for effective fire safety performance management.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the terminology, standards, procedures, and documentation related to fire and life safety audits.	Level 1: Remember
CO2	Explain the principles of fire and life safety auditing, fire safety management, and performance evaluation.	Level 2: Understand
CO3	Apply fire and life safety audit procedures, standards, and management practices to evaluate fire safety compliance.	Level 3: Apply
CO4	Analyze fire safety performance, audit findings, and corrective actions to improve fire and life safety management.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fire & Life Safety Audit Fundamentals: Introduction, objectives and need of fire and life safety audit, types of audits and inspections, legal and statutory requirements for fire safety audit, audit planning and methodology, pre-audit preparation, collection and verification of information, site inspection and cross verification, identification of non-compliance, audit documentation, preparation and submission of audit report, recommendations and corrective actions, advantages and limitations of fire and life safety audit, opening and closing meetings**.**

Unit-II

Audit Standards and Quality Assurance: Types of audits, components of fire and life safety audit, audit model and audit process, audit checklist and documentation, non-conformity reporting (NCR), fire load calculation and occupancy classification, reports from government agencies, consultants and experts, analysis of fire and property damage records, implementation of audit recommendations and corrective actions, organizational responsibilities for fire safety, audit report and action planning, standardization and quality assurance, overview of NBCS 2026 fire and life safety provisions, IS 14489:2018, ISO 9001, ISO 14001, ISO 45001, OISD standards, TAC guidelines, checklist for fire safety audit and inspection.

Unit-III

Fire Safety Management and Planning: Fire safety policy, scope and objectives of fire safety management, fire prevention strategies, organizational structure, roles and responsibilities, stakeholder consultation and participation, legal and regulatory compliance, provision of resources and support, leadership and commitment, management of change, fire safety training and competency requirements, emergency response planning, evacuation procedures, assembly points, mock drills, permit-to-work systems, emergency incident planning and post-incident management.

Unit-IV

Evaluation, Monitoring and Review: Workplace fire safety inspection, evaluation of compliance with fire safety legislation and standards, fire incident and near miss reporting and investigation, fire loss and damage analysis, performance monitoring indicators, internal fire safety audits, corrective and preventive actions, continual improvement techniques, management review, documentation and record keeping, review of fire safety performance and audit effectiveness.

Suggested Readings:

- Fundamentals of fire safety in building design by Dr. Than Singh Sharma, Aayush Publications.
- Essentials of Building Life and Fire Safety by Virendra Kumar Paul, COPAL Publishing Group.
- Fire Safety in Buildings by V. K. Jain, New Age International Publishers.
- National Building Construction Standards, 2026 by BIS New Delhi, India
- Occupational Health and Safety management by Chales D. Reese, Taylor & Francis Group.
- A Hand Book of Fire Technology by R.S. Gupta, Universities Press (India) Pvt. Ltd.
- Manual of Fire Safety by N. Sesha Prakash, CBS Publishers.

Course Code	**PCC-FT-302A**				
Category	Professional Core Courses				
Course Title	**Fire Testing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the objectives, standards, instrumentation and reporting procedures associated with fire testing practices. • To impart knowledge of the fire performance, combustion behavior and testing characteristics of different engineering materials. • To develop understanding of fire resistance evaluation methods for structural elements and passive fire protection systems. • To acquaint students with performance testing, inspection and quality assurance practices related to fire detection and fire suppression systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the principles, standards, terminology and testing methods associated with fire testing and evaluation procedures.	Level 1: Remember
CO2	Explain the fire behavior, combustion characteristics and performance evaluation of materials, structural elements and fire protection systems under fire conditions.	Level 2: Understand
CO3	Apply fire testing concepts and standard procedures for interpretation, inspection and performance assessment of fire protection materials and systems.	Level 3: Apply
CO4	Analyze fire test results, fire resistance performance and reliability of materials, structural assemblies and fire protection systems for safety evaluation.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit–I

Fundamentals of Fire Testing and Fire Test Standards: Objectives and significance of fire testing, Classification of fire tests, Reaction-to-fire and fire resistance tests, Standard fire exposure curves, Overview of BIS, ASTM, ISO, NFPA and UL fire testing standards, Laboratory instrumentation and measurement techniques, Sample preparation methods, Calibration procedures, Repeatability and reproducibility in fire testing, Fire test reporting and interpretation.

Unit–II

Fire Testing of Materials: Combustibility and non-combustibility tests, Flammability tests, Flame spread tests, limiting oxygen index test, Smoke density measurement, Toxic gas emission analysis, Heat release rate measurement using cone calorimeter, Fire testing of wood, Plastics, Rubber, Textiles, Cables and composite materials, Evaluation of thermal degradation and combustion characteristics of materials.

Unit–III

Structural Fire Resistance Testing: Fire resistance and fire endurance concepts, Furnace testing methods, Fire resistance rating, Testing of steel, Reinforced concrete and timber structural elements, Testing of fire doors, Fire walls and fire partitions, Temperature-time curves for structural fire testing, Passive fire protection systems and their evaluation, Interpretation of structural fire test results.

Unit–IV

Fire Testing of Detection and Suppression Systems: Performance testing of smoke, Heat and flame detectors, Testing and evaluation of fire alarm systems, Sprinkler discharge and performance testing, Testing of portable fire extinguishers, Foam quality and foam system performance tests, Fire testing of electrical cables and insulation systems, Quality assurance in fire testing laboratories, Inspection, Testing and maintenance practices for fire protection systems.

Suggested Readings:

- Fire Safety in Buildings by V.K. Jain, New Age International Publishers
- Fire Safety in Building by Dr. Than Singh Sharma
- Manual of Fire Safety by N Sesha Prakash, CBS Publishers and Distributors
- Fire Protection and Prevention: The Essential Handbook Volume 1 & 2 by B.M. Sen, UBS Publishers
- National Building Construction Standard 2026 by Bureau of Indian Standards (BIS)
- An Introduction to Fire Dynamics by Dougal Drysdale, Wiley
- Fire Protection Handbook by Arthur E. Cote, National Fire Protection Association (NFPA)
- SFPE Handbook of Fire Protection Engineering by Morgan J. Hurley, Springer
- ASTM Standards on Fire Testing of Materials and Structures by ASTM International
- NFPA Codes and Standards by National Fire Protection Association (NFPA)
- Enclosure Fire Dynamics by BjörnKarlsson and James G. Quintiere, CRC Press
- Fire from First Principles: A Design Guide to Fire Safety Engineering by Paul Stollard and John Abrahams, Routledge

Course Code	**PCC-FT-304A**				
Category	Professional Core Courses				
Course Title	**Fire Appliances and Rescue Equipments**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with different types of fire appliances, firefighting vehicles, fire pumps and associated operational systems used in fire services. • To develop the understanding of students regarding firefighting equipment, rescue tools, ladders, ropes and operational safety procedures used during emergency response. • To familiarize the students with rescue operations, casualty handling methods, incident command systems and personal protective equipment used in fire and rescue services. • To make the students learn about specialized rescue systems, modern firefighting technologies and advanced emergency response equipment used in contemporary fire services.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the terminology related to fire appliances, rescue equipment, personal protective equipment and modern firefighting technologies.	Level 1: Remember
CO2	Explain the principles, functions, and operational features of fire appliances, rescue equipment, personal protective equipment and modern firefighting technologies.	Level 2: Understand
CO3	Apply fire appliances, rescue equipment, personal protective equipment and rescue techniques in emergency response operations.	Level 3: Apply
CO4	Analyze the suitability and performance of fire appliances, rescue systems and modern firefighting technologies for different emergency scenarios.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fire Appliances and Firefighting Vehicles: Introduction to Fire Appliances, Classification of Fire Appliances, Functional Requirements of Fire Appliances, Fire Tender Chassis and Vehicle Design, Water

Tender, Foam Tender, Multipurpose Tender, Crash Fire Tender, Rescue Tender, Hose Laying Tender and Control Van, Fire Pumps and Priming Systems, Midship and PTO Pump Configurations, Hose Reels and Hose Management Systems, Water and Foam Monitors, Vehicle Stability and Load Distribution, Technical Specifications of Fire Appliances, Preventive Maintenance and Inspection Procedures.

Unit-II

Firefighting Equipment and Rescue Tools: Portable Fire Extinguishers and their Applications, Hydraulic Rescue Equipment, Hydraulic Cutters, Spreaders, Rams and Combi Tools, Pneumatic Rescue Equipment, Air Lifting Bags and Jacks, Electric Power Tools, Electric Cutters, Electric Saws and Chain Saws, Portable Lighting Systems and Power Sources, Ladders and Ladder Appliances, Extension Ladders, Hook Ladders, Turntable Ladders and Snorkels, Ropes and Lines Used in Fire Services, Knots, Hitches and Their Applications, Testing and Safety Procedures of Rescue Equipment.

Unit-III

Rescue Operations: Principles of Rescue Operations, Search and Rescue Techniques, Rescue Planning and Operational Safety, Casualty Handling Methods, One Rescuer and Two Rescuer Techniques, Multi Rescuer Techniques, Stretchers and Casualty Transportation Methods, Rescue from Fire Incidents and High-Rise Buildings, Rescue During Earthquakes, Floods and Other Disasters, Incident Command System (ICS) in Rescue Operations,

Personal Protective Equipments: Personal Protective Equipment (PPE), Safety Belts and Harnesses, Breathing Apparatus and Associated Equipment, Oxygen Breathing Apparatus, Compressed Air Breathing Apparatus, BA Control Systems and Cylinder Management, Gas Masks and Respirators, Airline and Filter Type Respirators.

Unit-IV

Specialized Rescue Systems and Modern Firefighting Technologies: SCUBA and Water Rescue Equipment, HAZMAT Rescue Equipment, Emergency Rescue Tender (ERT), HAZMAT Van and Decontamination Systems, Robotics in Firefighting and Rescue Operations, Drones in Fire and Rescue Services, Thermal Imaging Systems, Ultra High Pressure Systems (UHPS), Compressed Air Foam Systems (CAFS), Communication and Monitoring Systems in Emergency Response, Smart Fire Appliances and Sensor Networks, Artificial Intelligence in Fire and Rescue Operations, Recent Developments in Firefighting and Rescue Technologies.

Suggested Readings:

- Fire Safety in Buildings by V.K. Jain, New Age International Publishers
- Safety Management by R.K. Mishra, AITBS Publishers
- Manual of Fire Safety by N Sesha Prakash, CBS Publishers and Distributors
- Fire Protection and Prevention: The Essential Handbook Volume 1 & 2 by B.M. Sen, UBS Publishers
- National Building Construction Standard by Bureau of Indian Standards, New Delhi
- Related IS Codes, Standards and NFPA Manual

<table>
<tr><td>Course Code</td><td colspan="5">PCC-FT-306A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Automobile Engineering Safety</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To introduce students to the construction, classification and working principles of automobile engines and associated fuel systems.
To develop understanding of transmission, braking, suspension, steering and electrical systems used in automobiles.
To familiarize students with lubrication, cooling, pollution control techniques and modern developments in electric and hybrid vehicles.
To provide knowledge of fire fighting vehicles, automobile safety devices and relevant rules, regulations and standards related to automotive systems.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the terminology related to automobile systems, fire service vehicles, hybrid vehicles, and safety regulations.	Level 1: Remember
CO2	Explain the principles of automobile systems, transmission, steering, suspension, electrical systems, fire service vehicles, and safety standards.	Level 2: Understand
CO3	Apply the principles of automobile systems and safety regulations in the operation and maintenance of fire service vehicles.	Level 3: Apply
CO4	Analyze the performance of automobile systems and fire service vehicles to enhance operational safety and efficiency.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Automobiles, Types of automobiles, Various systems in automobiles, Engine classification, Construction, Details of engine components, Combustion in S.I. engines, Combustion in C.I. engines, Study of fuel system components, Function of carburetors, Construction details, Diesel fuel feed systems, Carburetion and mass distribution of mixture, Supercharging, Fuel injection and injection sections.

Unit II

Transmission System: Components of transmission system, PTO.
Clutch: Types, Construction, Operation and fault finding of clutches.
Gear Box: Types of gear box, Functions of gear box, Operation and maintenance of gear box.
Differential: Necessity, Construction of differential systems, Axles, Types and application.
Brakes: Types, Construction and operation of hydraulic, Pneumatic brake systems, Maintenance of brakes, Wheels and tyres.

Unit-III

Suspension: Necessity, Types, Construction and operation, Shock absorber, Coil springs, Independent suspension.

Steering System: Constructional details, Types of steering gear box, Steering geometry, Caster, Camber, King pin inclination, Effect of steering geometry on directional stability, Power steering.

Electrical System: Ignition systems, Magnet ignition, Battery ignition, Electronic ignition, Merits and demerits, Working, Self-starter, Dynamo voltage regulator, Battery construction, Operation and maintenance, Pollution, Air pollution, Euro norms, Pollution control techniques.

Lubricating System: Types, Components, Lubricating oil, Cooling system.

Unit-IV

Introduction to Electric and Hybrid Vehicles: Invention of hybrid automobile, Key features of hybrid automobile, Early hybrid vehicles, Woods gas-electric car, Hybrid automobiles.

Fire Fighting Vehicles

Fire Bikes: Construction & operation of fire bikes.

Tenders: Construction & operation of fire tenders and trucks.

Fire Boats: Construction & operation of fire boats & other water borne applications.

Rules and Regulations: CMV rules regarding safety devices for drivers, Passengers, Rules & regulations of RTO, Laboratory testing of vehicles, Road testing of vehicles, Automobile safety devices.

I.S. Codes: 15682, 15702, 15715, 15718, 15721, 15811, 15355, 19026, 19032.

Suggested Readings:

- Automobile Engineering Vol.I & II, Kirpal Singh, Standard Publishers.
- Automobile Engineering Vol.I, II & III, P.S. Gill, Kataria and Sons.
- Automobile Engineering, R. K. Rajput, Laxmi Publications.
- Automobile Engineering , R. B. Gupta, Satya Prakashan New Delhi.
- Automobile Engineering, Ramakrishna, PHI Learning Pvt. Ltd.
- Automobile Engineering , K. K. Jain, R. B. Asthana, Tata Mc Graw Hill.
- Automobile Mechanics, Crause, W. H.,Tata McGraw Hill.
- Automotive Mechanics, Joseph Heitner, East West Press.
- Course in Automobile Engineering, Sharma R. P, Dhanpat Rai and Sons
- Automotive Engines, Srinivasan S., Tata McGraw Hill.
- Motor Vehicle Technology, J.A. Dolan, Heinemann Educational Books.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Introduction to Automobile	https://youtu.be/H_RgFXjg-5s?si=yvCwREZctTNUVkoQ	NPTEL (IIT Madras)
	Vehicle Dimensions Engines	https://youtu.be/2b0YaDrdO1I?si=PQAU2EXqdeUcYEz4	NPTEL (IIT Madras)
Unit-II	Power Transmission System	https://youtu.be/0UhDnbsTuU8?si=vHC7cz_5xI80-qoA	NPTEL (IIT Madras)
	Wheels and Tyres	https://youtu.be/fVmBXtSKDw8?si=rtLK8GmGBTLxolhT	NPTEL (IIT Madras)
	Brakes	https://youtu.be/k3SeZgZWIqM?si=K-JySea_7QiE8gdB	NPTEL (IIT Madras)
Unit-III	Lubricating System	https://youtu.be/AGm2QSxYsVA?si=S7NWKIahRJb54CX7	NPTEL (IIT Guwahati)
	Steering Systems	https://youtu.be/HQr343nWLuI?si=I-CK4i-YXvjSJIO6	NPTEL (IIT Madras)
Unit-IV	Introduction to Electric and Hybrid Vehicles	https://youtu.be/_xM7X8k9g0s?si=nw2zatZCDZT5ULw9	NPTEL (IIT Kanpur)

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<tr><td>Course Code</td><td colspan="5">HSMC-FT-308A</td></tr>
<tr><td>Category</td><td colspan="5">Humanities and Social Sciences including Management courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Energy Environment Ethics and Society</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To make the students familiar with conventional and renewable energy resources, global energy scenarios, environmental challenges, and sustainable energy solutions.
To develop the understanding of students regarding the interaction between society, environment, population growth, technology, and environmental management practices.
To familiarize the students with ecosystem structure, biodiversity, environmental sustainability concepts, lifecycle assessment, environmental ethics, and international environmental standards.
To make the students learn ethical principles, professional ethics, moral values, organizational culture, and codes of ethics relevant to engineering and professional practices.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the terminology related to energy, environment, ecosystems, sustainability, and professional ethics.	Level 1: Remember
CO2	Explain the principles of energy resources, environmental systems, sustainable development, and ethical practices.	Level 2: Understand
CO3	Apply sustainability principles, environmental assessment methods, and ethical practices to engineering problems.	Level 3: Apply
CO4	Analyze the interrelationship between energy, environment, sustainability, and professional ethics in engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Energy Linkage with Development: World energy scenario, Fossil fuel resource- estimates and duration, India's energy scenario, Finite/ depleting energy resources, Coal, Oil, Gas, Nuclear fission, Promises and present status of nuclear fusion energy, Renewable energy, Solar, Hydro, Wind, Biomass, Ocean, Tidal, Wave and geothermal, Synergy between energy and environment, Global environment issues, Greenhouse gas emission, Global warming, Green energy solutions.

Unit-II

Society and environment: Exponential growth in population, Environment and optimum sustainable population, Free access resources and the tragedy of commons, Environment problems and impact of P.A.T (Population, Affluence and Technology), Environmentally beneficial and harmful technologies, Environment impact assessment policies and auditing, Interaction between environment, Life support systems and socio-culture system.

Unit-III

Ecosystem: Definition, Concepts, Structure, Realm of ecology, Lithosphere, Hydrosphere, Biosphere, Atmosphere, Energy balance to earth, Matter and nutrient recycling in ecosystems, Nitrogen, Oxygen, Carbon and water cycles, Food producers, Consumers and decomposers, Food chains, Biodiversity, Threat and conservation of biodiversity, Environmentally sustainable economic growth, Introduction to design for environment (DFE), Product lifecycle assessment for environment and ISO 14000, Triple bottom-line of economic, Environment and social performance, Environmental ethics, Its world impact and challenges.

Unit-IV

Ethics and Moral Values: Ethical situations, Objectives of ethics and its study, Role morality and conflicts, Values, Policies and organization Culture, Non-professional, Quasi- and hard professionals, Preventive, Personal, Common and professional ethics, Different ethical value criteria like utilitarian, Virtue, Right and duty ethics with discussion on the case of priority for improvement of urban (high traffic) or rural (low traffic) intersections causing equal number of fatalities, Codes of ethics and their limitations, Institute of engineers code for corporate member, IEEE and ACM professional-code.

Suggested Readings:

- A Textbook of Energy, Environment, Ethics and Society by H. K. Gupta and K. Gupta, Laxmi Publications Private Limited.
- Principles of Energy, Environment, Ethics and Society by R. Sivakumar and Vijay Nicole Pvt. Ltd.
- Energy, Environment Ecology & Society by D. K. Gupta and D. Gupta, Dhanpat Rai & Co. (P) Ltd
- Energy and Environment Management by R. Jain and A. Gupta, CBS Publishers.
- Energy and Environment in India: A Study of Energy Management by K.C. Gupta, Gyan Publishing House.
- Professional ethics in engineering by V Jayakumar, Lakshmi Publications
- Professional ethics - for engineers by D. G. Harkut and G.R. Bamnote, Notion press books.
- Environmental Engineering by M. P. Poonia, S.C. Sharma and S. Kumar, Khanna Book Publishing
- Environmental Issues in India by Ragarajan, Pearson India Publisher.
- Textbook of Environmental Engineering by P.V. Rao, PHI Learning Pvt Ltd

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Environment and development	https://youtu.be/moZIHBsP5fM?list=PLwdnzlV3ogoXmzczhk-7vTPBXBMhz56Hx	NPTEL (IIT Guwahati)
	Solar energy utilization methods	https://youtu.be/UHOZeiKgGAk	NPTEL (IIT Guwahati)
	Climate change and green house	https://youtu.be/iJDpJ3ODvVw	NPTEL (IIT Kanpur)
Unit-II	Ecology and environment	https://youtu.be/47Wtk0sGOng?list=PLyqSpQzTE6M_vO7rLpxKZWqai4uJP2bDa	NPTEL (IIT Madras)

	Environment Impact assessment	https://youtu.be/9-MEVIXr3Ko?list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67	NPTEL (IIT Roorkee)
Unit-III	Ecology and environment	https://youtu.be/ib97cb6rNBg	NPTEL (IIT Madras)
	Biodiversity	https://youtu.be/SHxAOoxhKTA	NPTEL (IIT Kanpur)
	EIA and life cycle assessment	https://youtu.be/sOdmK34gn3c	NPTEL (IIT Madras)
Unit-IV	Engineering ethics	https://youtu.be/EVWcuFXeSgk?list=PLbRMhDVUMngdL7ofhT7uH9_XBk4-2qsIL	NPTEL (IIT Kharagpur)
	Ethical Theories	https://youtu.be/HtOlPvsu7CE	NPTEL (IIT Kharagpur)

Course Code	**LC-FT-310A**				
Category	Professional Core Courses				
Course Title	**Fire Testing Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To impart practical knowledge of fire testing procedures and standard methods used for evaluation of combustible and structural materials. • To develop experimental understanding of flammability, flame spread, smoke generation and heat release behavior of materials under fire conditions. • To acquaint students with fire resistance assessment techniques for structural components, fire doors and electrical insulation systems. • To provide hands-on exposure to testing, calibration and performance evaluation of fire detection and firefighting equipment.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Conduct flammability, limiting oxygen index, flame spread and smoke density tests on combustible and building materials using standard fire testing procedures.	Level 3: Apply
CO2	Determine the heat release characteristics and fire resistance performance of structural, insulation and electrical materials through laboratory fire testing methods.	Level 3: Apply
CO3	Test and calibrate fire detection and firefighting equipment for evaluation of operational and discharge performance characteristics.	Level 3: Apply
CO4	Evaluate the fire performance and resistance characteristics of materials, structural elements and fire protection equipment based on experimental observations and test results.	Level 4: Analyze

List of Experiments:

Sr. No.	**Contents**
1	To conduct horizontal and vertical flammability tests on combustible materials.
2	To determine the limiting oxygen index (LOI) of solid combustible materials.
3	To conduct flame spread test on building materials.
4	To measure smoke density generated from combustible materials.

5	To determine the heat release rate of materials using cone calorimeter.
6	To conduct fire resistance test on steel structural specimens.
7	To conduct fire resistance test on RCC structural elements.
8	To evaluate the fire integrity and insulation performance of fire doors.
9	To conduct fire resistance test on electrical cables and insulation materials.
10	To test and calibrate smoke detectors.
11	To determine the foam expansion ratio and drainage time of firefighting foam.
12	To evaluate the performance and discharge characteristics of portable fire extinguishers.

At least 8 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

<table>
<tr><td>Course Code</td><td colspan="5">LC-FT-312A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Automobile Safety Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide practical knowledge of automobile engine systems, fuel systems and vehicle subsystems with emphasis on operational safety and hazard prevention.
To develop understanding of transmission, steering, suspension and braking systems used for vehicle stability and safe operation.
To familiarize students with automotive safety devices, intelligent vehicle safety technologies and accident prevention systems.
To provide hands-on exposure to emission control technologies, vehicle safety inspection procedures and safety systems in electric and hybrid vehicles.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the construction, working and safety aspects of automobile engines, ignition systems and fuel systems.	Level 2: Understand
CO2	Discuss the operation and safety features of transmission, suspension and steering systems used in automobiles.	Level 2: Understand
CO3	Apply automotive safety principles for understanding braking systems, stability systems and passenger protection systems.	Level 3: Apply
CO4	Analyze the performance and safety aspects of emission control systems and electric and hybrid vehicle safety systems.	Level 4: Analyze

List of Experiments

Sr. No.	Contents
1	To study the constructional details, working principles, operational safety, and hazard prevention methods in multi-cylinder petrol and diesel engines.
2	To study the role of cooling and lubrication systems in preventing overheating, frictional wear, fire hazards, and engine failure.
3	To study the safe operation and functioning of engine starting systems, contact point ignition systems, and electronic ignition systems.
4	To study the construction, working principles, and safety aspects of carburetors, diesel fuel injection systems, and gasoline fuel injection systems.
5	To study the constructional details, working principles, and safe operation of coil spring clutch, diaphragm spring clutch, and double disc clutch systems.
6	To study the operation and safety features of synchromesh gearbox, transaxle with dual-speed range, four-wheel drive systems, and transfer cases.

7	To study rear-wheel drive, front-wheel drive, differentials, drive axles, and four-wheel drive systems with emphasis on stability and safe torque transmission.
8	To study front and rear suspension systems and their role in ride comfort, vehicle stability, vibration reduction, and accident prevention.
9	To study manual steering, rack and pinion steering, power steering systems, tilt and telescopic steering wheels, and collapsible steering columns.
10	To study various types of bias-ply tyres, radial tyres, wheel constructions, wheel balancing, and tyre safety parameters.
11	To study the construction, operation, and safety aspects of hydraulic and pneumatic braking systems.
12	To study the working principles, efficiency, and operational safety of drum brake and disc brake systems.
13	To study the operation and safety features of ABS, parking brake systems, and auxiliary braking systems.
14	To study seat belts, airbags, headrests, crumple zones, side-impact protection systems, and child safety features.
15	To study traction control systems (TCS), electronic stability control (ESC), lane departure warning systems, adaptive cruise control, and collision avoidance systems.
16	To study emission control technologies such as catalytic converters, exhaust gas recirculation (EGR), evaporative emission control systems, and vehicular pollution standards.
17	To study vehicle safety inspection procedures, lighting systems, warning devices, mirrors, and accident prevention measures.
18	To study battery safety, electrical isolation systems, thermal runaway prevention, charging safety, and emergency shutdown systems in electric and hybrid vehicles.

Note:At least 10 experiments to be performed from the above list and other experiment can be performed depending upon the scope of course as decided by the department.

Course Code	**LC-FT-314A**				
Category	Professional Core Courses				
Course Title	**Basic Computer Skills and AutoCAD Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop the understanding of students regarding the use of Microsoft Office tools for document preparation, spreadsheet management, data analysis, and technical presentations. • To familiarize the students with formatting, editing, graphical representation, and file management techniques using MS Word, MS Excel, and MS PowerPoint. • To make the students learn the fundamentals of AutoCAD software, drawing environment setup, and preparation of engineering drawings using standard drafting practices. • To develop the practical skills of students in creating, editing, analyzing, and presenting technical and engineering drawings using computer-based applications and drafting tools.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the functions and applications of Microsoft Word, Excel and PowerPoint tools used for document processing, data handling and presentation preparation.	Level 2: Understand
CO2	Apply formatting, calculation, chart creation and presentation techniques using Microsoft Office applications.	Level 3: Apply
CO3	Apply AutoCAD commands and drawing tools for creation of engineering drawings and drafting layouts.	Level 3: Apply
CO4	Analyze and prepare engineering component drawings and sectional views using AutoCAD software.	Level 4: Analyze

List of Experiments

1. To study the basics of Microsoft Word.

a) File Management:

- Opening, creating and saving a document, locating files, copying contents in some different file(s)

b) Editing a document:

- Entering text, cut, copy, paste using toolbars,
- Use of spell check
- PDF file and its conversion in different file formats (MS Word/Excel etc.)
- Scanning, editing and printing of a document

c) Formatting a document:

- Using different fonts, changing font size and colour, changing the appearance through bold/ italic/ underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
- Aligning of text in a document, justification of document, Inserting bullets and numbering Formatting paragraph,

- Inserting page breaks and column breaks, line spacing
- Use of headers, footers, inserting footnote, end note,
- use of comments, Inserting date, time, special symbols, importing graphic images, drawing tools

d) Tables and Borders:

- Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
- How to change docx file to doc file
- Print preview, zoom, page setup, printing options
- Using Find, Replace options

2. To study the basics of Microsoft Excel.

a) **Starting Excel open worksheet**: enter, edit data, formulae to calculate values, format data, create chart, printing chart, save worksheet, switching between different spreadsheets.

b) **Menu commands:** Create, format charts, organize, manage data, solving problem by analyzing data, creating graphs

c) **Work books:** Managing workbooks (create, open, close, save, rename), working in work books Editing a worksheet: copying, moving cells, pasting, inserting, deleting cells, rows, columns, find and replace text, numbers of cells, formatting worksheet

d) **Creating a chart:** Working with chart types, changing data in chart, formatting a chart, use chart to analyze data using a list to organize data, sorting and filtering data in list

e) **Formulas:** Addition, subtraction, division, multiplication, percentage and auto sum

3. To study the Microsoft Power point Presentation.

a) **Introduction to PowerPoint** How to start PowerPoint Working environment: concept of toolbars, slide layout, templates etc. Opening a new/existing presentation Different views for viewing slides in a presentation: normal, slide sorter etc.

b) Addition, deletion and saving of slides

c) **Insertion of multimedia elements:** Adding text boxes, importing pictures, tables and charts etc.

d) Formatting slides, Text formatting, changing slide layout, changing slide colour scheme Changing background, Applying design template

e) **Slide Show:** Viewing the presentation using slide navigator, Slide transition Animation effects etc.

4. To study various commands used in Auto- CAD software.

5. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.

6. Layout drawing of a building using different layer and line colors indicating all Building details.

7. To make a drawing of line, arc, circle, ellipse, triangle etc.

8. To make a drawing of a flange.

9. To make a drawing of a bushing assembly.

10. To make an isometric dimensioned drawing of a connecting rod using isometric grid and snap.

11. To make different types of bolts and nuts with internal and external threading in ACME and square threading standards.

12. To make a quarter sectional isometric view of a cotter joint.

At least 8 experiments to be performed from the above list and other experiment can be performed depending upon the scope of course as decided by department.

<table>
<tr><td>Course Code</td><td colspan="5">LC-FT-316A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Fire Ground Operations–VI (Rescue Operations)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To develop the understanding of students regarding rescue techniques, lifting and carrying methods, knots, and emergency response procedures used in firefighting and rescue operations.
● To familiarize the students with firefighting tenders, rescue tools, power tools, firefighting equipment, and personal protective equipment used during rescue and emergency operations.
● To make the students learn the construction, operation, technical specifications, and practical applications of breathing apparatus sets and rescue equipment used in hazardous environments.
● To develop the practical skills of students in performing rescue drills, confined space rescue, well rescue, building rescue, and emergency response operations under different accident scenarios.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the principles, applications, and operational procedures of rescue techniques, rescue tools, firefighting equipment, personal protective equipment, and breathing apparatus sets.	Level 2: Understand
CO2	Demonstrate lifting and carrying methods, knot practices, breathing apparatus drills, pump drills, and rescue procedures using appropriate rescue and firefighting equipment.	Level 3: Apply
CO3	Perform rescue operations in confined spaces, wells, buildings, and accident scenarios using suitable rescue tools, harness systems, and emergency response techniques.	Level 3: Apply
CO4	Analyze the operational requirements, equipment selection, and safety considerations involved in firefighting and rescue operations under different emergency conditions.	Level 4: Analyze

List of Experiments

Sr. No.	Contents
1	To practice different lift and carries.
2	To practice different types of knots using ropes.
3	To study different types of tenders (through industrial visits).
4	To study different types of Rescue tools and their applications.
5	To study different types of Power tools and their applications.
6	To study different types of Fire Fighting tools and their applications.
7	To study personal protecting equipments and their uses.
8	To study B.A. Set, its technical specifications and to perform drill using B.A. Set.
9	To study the types of B.A. Set: a) Open circuit b) Closed circuit
10	To perform rescue drill using full body harness.
11	To perform six men pump drill with pump test.
12	To perform drills on rescue from well.
13	To perform drill on rescue from confined space like tunnels.
14	To perform drills on Rescue from building.
15	To perform drills on rescue from accidents/incident.

Other drills and tests can be performed as decided by department (time to time) depending upon the scope of course.

Course Code	**PEC-FT-318A**				
Category	Professional Elective Courses				
Course Title	**Fire Modelling**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the fundamentals of fire modelling, simulation techniques and computational approaches used in fire safety engineering. • To develop understanding of numerical methods, thermodynamic principles and simulation analysis tools used in fire simulations. • To familiarize students with turbulence modelling, combustion phenomena and advanced fire dynamics simulations. • To provide knowledge of fire suppression modelling, model validation techniques and applications of fire simulations in engineering systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the terminology related to fire modelling, numerical methods, fire dynamics, combustion, and fire suppression.	Level 1: Remember
CO2	Explain the principles of fire simulation, numerical modelling, turbulence, combustion, and model validation.	Level 2: Understand
CO3	Apply fire modelling and numerical simulation techniques to predict fire behavior and suppression performance.	Level 3: Apply
CO4	Analyze fire simulation results and model performance to assess fire safety in engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question no. one will have 6 parts of 2 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Fire Simulation and Modelling: Introduction to fire modelling and simulation, Basic model forms, Deterministic and probabilistic models, Basic simulation approaches, Handling stepped and event-based time in simulations, Discrete and continuous modelling, Numerical techniques in simulations, Sources and propagation of errors, Dynamical system simulations, Finite state simulations, Complex model simulations, Graph and network-based simulations, Actor-based simulations, Mesh-based simulations, Hybrid simulations, Introduction to parallel and distributed simulations, Data partitioning, Algorithm partitioning, Handling inter-partition dependencies, Introduction to probability and statistics for simulations, Queuing systems, Random noise, Random variate generation, Sensitivity analysis.

Unit-II

Numerical Methods and Simulation Analysis: Simulation result analysis and visualization tools, Display forms, Tables, Graphs, Multidimensional visualization techniques, User interfaces and web-based visualization tools, Validation and verification of model results, Index notation and matrix operations, Fundamentals of thermodynamics, Equation of state, Chemical and phase equilibrium, Droplet mass, Momentum and energy transfer, Taylor series expansion, Order of accuracy, Numerical time integration methods, Explicit and implicit numerical schemes, Finite difference methods, Stability restrictions, Lax equivalence theorem, Derivation of mass, Momentum and energy conservation equations, Pressure Poisson equation, Projection methods, Scalar transport schemes, Godunov's theorem.

Unit-III

Advanced Fire Dynamics and Turbulence Modelling: Time-splitting methods for source terms, Non-dimensional governing equations, Compressible and low-Mach number flow formulations, Velocity divergence constraints for low-Mach number flows, Thermal radiation modelling, Discrete ordinates method, Beer's law, Fundamentals of turbulence theory, Vortex dynamics, Kolmogorov and Batchelor theories, Energy and power spectra, Direct Numerical Simulation (DNS), Length scale requirements, Parallel computing in fire simulations, Estimation of computational cost, Reynolds Averaged Navier–Stokes (RANS) models, Turbulence modelling approaches, Statistical correlations, Large Eddy Simulation (LES), Sub-grid scale closures, Filtering techniques, Energy spectrum analysis, Nyquist limit and aliasing effects.

Unit-IV

Combustion, Fire Suppression and Model Validation: Turbulent boundary layers, Grid generation and mesh design, Mesh quality metrics, Models for mean chemical source terms, Turbulent combustion modelling, Extinction and ignition phenomena, Under-ventilated combustion, Formation of toxic products including carbon monoxide and soot, Pyrolysis, Flame spread mechanisms, Fire suppression modelling techniques, Water mist and suppression systems, Smoke movement and control, Model validation techniques, Verification procedures, Uncertainty quantification in fire modelling, Analysis of model input and output uncertainties, Applications of fire modelling in buildings, industrial facilities, and transportation systems.

Suggested Readings

- Introduction to Mathematical Fire Modeling, Second Edition By Marc L.Janssens.
- Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's
- Surface Fire Spread Model by Joe H. Scott, Robert E. Burgan.

Course Code	**PEC-FT-320A**				
Category	Professional Elective Courses				
Course Title	**Safety Practice in Chemical and Nuclear Industries**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the fundamentals of chemical process safety, industrial toxicology and occupational safety practices in chemical industries. • To develop understanding of fire, explosion and electrical hazards associated with chemical process industries and their preventive measures. • To familiarize students with process safety engineering, hazard evaluation techniques and risk assessment methodologies used in chemical plants. • To provide knowledge of nuclear safety engineering, radiation hazards and emergency preparedness measures in nuclear installations.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the terminology related to chemical process safety, fire and explosion hazards, risk assessment and nuclear safety.	Level 1: Remember
CO2	Explain the principles of chemical process safety, fire and explosion prevention, process risk assessment and nuclear safety systems.	Level 2: Understand
CO3	Apply process safety, fire protection, risk assessment and nuclear safety principles to industrial applications.	Level 3: Apply
CO4	Analyze chemical process hazards, fire and explosion risks and nuclear safety systems to recommend appropriate control measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Chemical Process Safety: Introduction to chemical process industries, Major chemical and oil industry disasters: Flixborough disaster, Seveso disaster, Mexico LPG disaster, Bhopal disaster, Phillips disaster, Chemical hazards and hazard symbols, Incompatible chemicals, Fire classification, occupational safety and health regulations, The Factories Act, personal protective equipment (PPE), Toxic substances and industrial toxicology, Classes of toxicity, Routes of exposure, Effects of toxic substances, Dose-response relationship, Threshold limit values (TLV), Exposure standards, Airborne contaminants, confined space hazards, Respiratory protection, Prevention and control measures.

Unit-II

Fire, Explosion and Electrical Hazards in Chemical Industries: Workplace hazards, Dangerous substances, Fire triangle and fire tetrahedron, Ignition sources, Static electricity, Flammable and combustible liquids, Flash point, Flammability limits, Limiting oxygen concentration (LOC), Flammability diagrams, Explosion phenomena: BLEVE, Vapor cloud explosion (VCE), Detonation and deflagration, Electrical hazards, Causes and effects of electric shock, Path of electric current, Sources of electrostatic discharge, Grounding and bonding, Control of static electricity, Electrical hazard reduction techniques**.**

Unit-III

Process Safety Engineering and Risk Assessment: Decomposition and runaway reactions, Initiating factors, reactive chemical hazards, Thermal explosion hazards, Process hazard evaluation techniques, Process flow diagrams (PFD), Piping and instrumentation diagrams (P&ID), Process control systems, Alarms and interlocks, Chemical plant layout, Passive and active fire protection systems, Emergency shutdown systems, Safety integrity level (SIL), Inherent safety techniques, Hazard identification and risk assessment, HAZOP, Dow Fire and Explosion Index, Reliability concepts, Fault tree analysis (FTA), Event tree analysis (ETA), case studies: T2 Laboratories, Florida Synthon, North Carolina incident, Phenol-formaldehyde reaction.

Unit-IV

Nuclear Safety Engineering: Comparison of coal and nuclear power plants, Indian nuclear power scenario, three-stage nuclear power program, Nuclear fuels and fuel cycle, Types of nuclear reactors, Environmental aspects of nuclear power, Radiation and radiation hazards, Radiation protection principles, Defense in depth, multiple barrier concept, Reactor shutdown systems, Emergency core cooling systems, Passive safety systems, Sodium leak and fire protection, Design basis and beyond design basis accidents, Nuclear power plant licensing, PHWR, CANDU and FBR safety features, International Nuclear and Radiological Event Scale (INES).

Major Nuclear Accidents: Chernobyl and Fukushima, Risk management and emergency preparedness in nuclear installations.

Suggested Readings:

- Chemical Process Safety: Fundamentals with Applications by Daniel A. Crowl and Joseph F. Louvar, Prentice Hall, Sterling book House
- Industrial Safety and Health Management by R.K. Jain, Sunil S. Rao, Khanna Publications.
- Safety Management, 1st Edition by R.K. Mishra, AITBS Publisher India.
- Fundamental of industrial safety and health by KU Mistry, Shyamaraj Global Commerce.
- Industrial Safety Management by Pravin M. Pathak, Jayant P. Khairnar, Notion Press.
- Principles of Industrial Safety Management: Understanding the Ws of Safety at Work by Akhil Kumar Das, PHI Learning
- Industrial Safety Management by Naseer Elahi, Kalpaz Publications.
- Safety Management System and Documentation Training Programme Handbook (Pb 2019) by SV Paul, CBS Publication.
- Safety, Occupational Health and Environmental Management in Construction by S.C.Sharma, Vinit Kumar, Khanna Publishers.
- Industrial Safety and Maintenance Managementby M.P. Poonia, S.C. Sharma, P. Sojan Lal, Khanna Publishing House, New Delhi
- A Handbook On Industrial Safety and Fire Managementby Ravi Kant Pandey, ChetanPrakashan

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Chemical industry accident	https://youtu.be/VhuZ6M7a8N8	NPTEL (IIT Kharagpur)
	Chemical hazard	https://youtu.be/n1s1UB80JgA	NPTEL (IIT Kharagpur)
	PPE confined space safety	https://youtu.be/WxyfKNQkj8g?list=PLp6ek2hDcoNCd093zjHjuo4Lu_pIr3rFr	NPTEL (IIT Delhi)
Unit-II	Fire triangles	https://youtu.be/eLeZ2zc2hgI	NPTEL (IIT Madras)
	Flammability and flash point	https://youtu.be/6btv5t8DYXU	NPTEL (IIT Roorkee)
Unit-III	Thermal explosion	https://youtu.be/O_FWY7vlAzs	NPTEL (IIT Madras)
	Runway: explosion at T2 laboratory	https://youtu.be/C561PCq5E1g	NPTEL (IIT Madras)
	Industrial safety integrity	https://youtu.be/jFDWlKayrTc	NPTEL (IIT Kharagpur)
Unit-IV	Nuclear reactor and safety	https://youtu.be/vQ5HrubRYVo?list=PLbMVogVj5nJR6nZje9ewAeZ7lvnoVV1X3	NPTEL (IIT Madras)
	Event tree analysis	https://youtu.be/ikbC5_6qTvs	NPTEL (IIT Kharagpur)

Course Code	**PEC-FT-322A**				
Category	Professional Elective Courses				
Course Title	**Building Design and Drawing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To develop the understanding of students regarding building drawing, building elements, foundations, doors, windows, staircases, roofs, trusses, and other structural components used in building construction. • To make the students familiar with NBCS–2026 provisions, building bye-laws, FAR, setbacks, architectural composition, planning principles, and building orientation. • To make the students learn building services such as water supply, drainage, electrification, ventilation, lighting, and fire safety services along with fire service layouts and arrangements. • To familiarize the students with the design and preparation of residential, commercial, and institutional building drawings including elevations, sections, ventilation, smoke ventilation, and energy efficient building concepts.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the terminology related to building planning, building elements, services, and fire safety drawings.	Level 1: Remember
CO2	Explain the principles of building planning, building services, fire protection systems, and building design.	Level 2: Understand
CO3	Prepare building and fire service drawings in accordance with applicable standards and functional requirements.	Level 3: Apply
CO4	Analyze building layouts and fire protection provisions to ensure safe and efficient building design.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit–I

Drawing of Building Elements: Drawing of various elements of buildings like footing, open foundation, raft, grillage, pile and well foundation, Drawing of frames of doors, windows, various types of door, window and ventilator, lintels and arches, stairs and staircases, trusses, flooring and roofs.

Unit–II

Building Planning: Provisions of National Building Construction Standards- 2026, Building bye-laws, open areas, setbacks, FAR terminology, Principles of architectural composition (i.e. unity, contrast etc.), Principles of architectural planning and orientation.

Unit–III

Building Services: Water supply, Drainage, Electrification, Ventilation, Lighting and Fire safety services.
Building Fire Services: Layout of water tank compartment, Pump house layout, Main fire pump, Stand by pump and Jockey pump arrangement, Drawings of hydrant post, Hose box, Hose reel, Dry riser, Wet riser and Down comer.

Unit–IV

Design and Drawing of Building: Design and preparation of detailed drawings of various types of building like residential, Commercial and Institutional buildings with elevation and sectional details, Functional requirements of buildings, Ventilation, Smoke ventilation and Energy efficient buildings, Introduction to perspective drawing.

Suggested Readings:

- Building Design and Drawing by Vs Limaye and Ad Pawar, Nirali Prakashan
- Building Drawing: with an integrated approach to built environment by M.G. Shah, C.M. Kale and S.Y. Patki, McGraw-Hill
- Building Services Handbook by Fred Hall & Roger Greeno, Routledge
- Building Construction by B.C. Punmia, Er. Ashok Kumar Jain & Dr. Arun Kumar Jain, Laxmi
- Fire Safety in Buildings by V.K. Jain, New Age International Private Limited

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Design of footing	https://youtu.be/8ATp13mOhvg?si=lCdLVnSfxItfd6W7	NPTEL (IIT Kharagpur)
	Design of Staircases	https://youtu.be/hxakW1miEcM?si=JnL-cIKJ1CF77ggY	NPTEL (IIT Kharagpur)
Unit-II	Introduction to Planning and Scheduling	https://youtu.be/Nto1VbJSQWs?si=mggmAURIE0BN-CoP	NPTEL (IIT Kanpur)
	National Building Code 2016 Part I	https://youtu.be/Dpy40oDxtfw?si=2QRKk3TJkech6Rq5	NPTEL (IIT Madras)
	National Building Code 2016 Part II	https://youtu.be/rVasz5j-2L8?si=T-zA_1DHTT1lv6ia	NPTEL (IIT Madras)
Unit-III	Design of Water Supply System	https://youtu.be/JIKkqI7yqW4?si=Wj7a_oUKZH_9NZnV	NPTEL (IIT Delhi)
	Electrification	https://youtu.be/EC72aSUGqTM?si=IpSaLI91nUn95gLB	NPTEL (IIT Delhi)
	Fire Safety: Urban Planning	https://youtu.be/eAKTwc3_ixE?si=8czptB1wtBCA0yBs	NPTEL (IIT Delhi)
Unit-IV	Perspective Drawing	https://youtu.be/xclQPSp2SQw?si=VvcDZBu8dvUtwwie	NPTEL (IIT Madras)

Course Code	**PEC-FT-324A**				
Category	Professional Elective Courses				
Course Title	**Industrial Hygiene and Occupational Health**				
Scheme and Credits	L	T	P	**Credits**	**Semester -VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to chemical, physical and occupational hazards associated with industrial work environments. • To develop understanding of industrial ventilation, exposure assessment and occupational hygiene practices for hazard control. • To familiarize students with occupational diseases, medical surveillance systems and workplace health protection measures. • To provide knowledge of personal protective equipment, respiratory protection systems and regulatory requirements for occupational safety management.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the terminology related to industrial hygiene, occupational health, workplace hazards and personal protective equipment.	Level 1: Remember
CO2	Explain the principles of industrial hygiene, occupational health, hazard control, ergonomics and personal protective equipment.	Level 2: Understand
CO3	Apply industrial hygiene practices, hazard control measures, occupational health procedures and personal protective equipment for workplace safety.	Level 3: Apply
CO4	Analyze workplace hazards, occupational health risks and personal protective equipment requirements to recommend appropriate control measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Chemical Hazards: Introduction to industrial hygiene, Types of chemical hazards in industry: Dust, Gases, Fumes, Mists, Vapours and smoke. Toxicological properties of chemicals and routes of exposure, Exposure assessment and air sampling techniques, Personal and area monitoring, Threshold limit values (TLV), Permissible exposure limits (PEL) and occupational exposure standards, Effects of key industrial chemicals such as chlorine, Ammonia, and other toxic gases. Storage, Handling and transportation of hazardous chemicals, Chemical safety in process industries.

Industrial Ventilation: Principles of natural and mechanical ventilation, General and local exhaust ventilation systems, Design considerations and control of airborne contaminants.

Unit-II

Physical Hazards: Illumination and lighting standards, Thermal radiation, Ultraviolet and ionizing/non-ionizing radiation, Preventive and control measures.
Noise: Measurement techniques, Noise surveys, Noise dose, Hearing loss mechanisms and noise control methods.
Vibration: Types, Effects on human body, Hand-arm and whole-body vibration, Isolation techniques.
Thermal Stress: Heat balance, Heat stress indices, Heat disorders, Prevention and control measures.
Work physiology: Classification of workload, Human energy expenditure, Work capacity, Job–man alignment, Fatigue and recovery.
Ergonomics: Principles, Human-machine interaction, Posture analysis and methods of reducing musculoskeletal and postural strain in industry.

Unit-III

Occupational Health and Diseases: Concept of occupational health and industrial medical services, Occupational diseases- Silicosis, Asbestosis, Pneumoconiosis, Lead, Nickel, Chromium, Manganese toxicity and their effects, Occupational cancer, Occupational dermatitis and other work-related diseases: Causes, Exposure pathways and prevention strategies, Medical surveillance of workers, Occupational health centre, Health records and reporting systems, Prevention and control of occupational diseases, Occupational hygiene practices and health risk reduction strategies, Occupational disease compensation systems and legal provisions, Fundamentals of first aid and emergency medical response in industries.

Unit-IV

Non Respiratory Personal Protective Equipments: Head protection, Hearing protection, Face and eye protection, Feet protection, Body protection, Selection, Use, Inspection, Care and maintenance of personal protective equipment.
Respiratory Personal Protective Equipments: Classification of respiratory hazards, Types of respirators and breathing apparatus, Selection criteria, Usage procedures and training requirements, Selection of respirators, Care & maintenance of breathing apparatus.
Workplace safety laws and regulatory requirements related to PPE usage, Industrial safety management practices for PPE compliance and occupational risk reduction.

Suggested Readings

- Industrial Safety and Health Management by R.K. Jain, Sunil S. Rao, Khanna Publications.
- Safety Management, 1st Edition by R.K. Mishra, AITBS Publisher India.
- Fundamental of industrial safety and health by KU Mistry, Shyamaraj Global Commerce.
- Industrial Safety Management by Pravin M. Pathak, Jayant P. Khairnar, Notion Press.
- Principles of Industrial Safety Management: Understanding the Ws of Safety at Work by Akhil Kumar Das, PHI Learning
- Industrial Safety Management by Naseer Elahi, Kalpaz Publications.
- Safety Management System And Documentation Training Programme Handbook (Pb 2019) by SV Paul, CBS Publication.
- Safety, Occupational Health and Environmental Management in Construction by S.C. Sharma, Vinit Kumar, Khanna Publishers.
- Industrial Safety and Maintenance Management by M.P. Poonia, S.C. Sharma, P. Sojan Lal, Khanna Publishing House, New Delhi

Course Code	**PEC-FT-326A**				
Category	Professional Elective Courses				
Course Title	**Nuclear Reactors and Safety**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to nuclear reactor fundamentals, radiation principles and nuclear power generation systems. • To develop understanding of nuclear reactor safety principles, event analysis and emergency response strategies in nuclear facilities. • To familiarize students with quality assurance practices, environmental safety considerations and site evaluation criteria for nuclear installations. • To provide knowledge of nuclear safety regulations, licensing procedures and safety review practices followed in nuclear industries.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the principles of nuclear reactors, radiation behaviour, reactor components, quality, environmental safety and nuclear fuel cycle processes.	Level 1: Remember
CO2	Explain nuclear reactor safety principles, radiation protection measures, event analysis methods, emergency response procedures, nuclear safety regulation used in nuclear facilities.	Level 2: Understand
CO3	Apply quality assurance, environmental safety and regulatory concepts for evaluation of nuclear safety practices and reactor operations.	Level 3: Apply
CO4	Analyze nuclear reactor incidents, safety systems and regulatory measures for improving nuclear safety and risk management.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Nuclear Reactor Fundamentals and Radiation: Energy sources, Nuclear Power, Production, Medical and societal applications of radiation, Nuclear fuel cycle, Basic Physics of Nuclear Reactors: Atomic Structure, Isotopes, Radioactivity, Half-life, Basics of fission reaction, Moderation, Criticality, Decay heat, Reactivity and Feedback, Breeding, Nuclear Reactor Types, Components of Nuclear Reactor, Present Reactor Types, Generation IV Concepts, Radiation sources and Protection, Radiation and its units, Natural, background and man-made Radiation, Biological Effects, Exposure limits and protection, Sources of radiation, shielding.

Unit-II

Nuclear Reactor Safety and Event Analysis: Safety Principles, Safety objectives, Defence in depth philosophy, Multiple barriers, Radwaste management, Levels of defence, Redundancy, Diversity Principles, Event analysis, core inventory, Emergency response, Safety Approach, Deterministic approach – Design Basis, Events and Beyond Design Basis Events, Acceptance Criteria, Probabilistic approach – Fault tree, Event tree, Failure rates. History of Events in Nuclear reactors and facilities, INES Scale, TMI, Chernobyl, Fukushima, Windscale, Thorp Reprocessing, Kyshtym, Vandellos, Tokaimura, NRX, David Besse, Enrico Fermi, Narora Fire, Monju and FBTR Sodium Leak, Radiation over exposures in Industry and Medical applications. Analysis of Some Events in NPP, Heat transfer and Fluid flow prediction, validation, Safety set points, Safety actions for events, Spurious opening of Pressurizer valve in a PWR, LOCA analysis Indian, PHWR, Station Blackout without Reactor Trip, FBTR.

Unit-III

Quality and Environmental Safety: Quality Assurance, Quality Assurance Plan, materials, Design, Fabrication, Maintenance, Surveillance, In Service Inspection, Training & Qualification, Quality Audit. Siting of Nuclear plants, Site evaluation Stages, Site Rejection Criteria, Earthquake, Geological criteria, Meteorological considerations, Flooding, Tsunami, Shoreline erosion, chemical explosion, Radiological impact study, Radioactivity path ways to humans, environmental Impact study.

Unit-IV

Nuclear Safety Regulation: Safety Regulation in India, Atomic Energy Regulatory Board, functions, safety Documents, Safety Review of site, design, regulatory inspections, safety review for PFBR, Koodankulam, Regulatory review of operating plants, Licensing stages, licensing of operating personnel, Training simulator, safety up-gradation, Review after TMI Chernobyl, Review after Fukushima, safety review for decommissioning, Safety Review of Radiation Facilities, medical X-ray units, Gamma irradiators, Safety Practices in India.

Suggested Readings:

- Nuclear Reactor Engineering (Principles and Concepts) by G. Vaidyanathan, S. Chand & Company, New Delhi
- Elements of Nuclear Safety by Jacques Libmann, Les Editions de Physique
- Nuclear Power Reactor Safety by E. E. Lewis, John Wiley and Sons, New York
- Nuclear Safety by Gianni Petrangeli, Butterworth-Heinemann
- NPTEL Web Course on Nuclear Reactor Technology by K. S. Rajan
- Radioactive Materials by B. M. Rao, Himalaya Publishing House

Useful Video Links:

Unit No.	Topic	Link	Source
Unit-I	Nuclear power generation	https://youtu.be/oPZrUW9GQRg?si=EK1gh_uKq7FaWxIb	NPTEL (IIT Guwahti)
	Nuclear reactions	https://youtu.be/vQ5HrubRYVo	NPTEL (IIT Madras)
Unit-II	Nuclear reactor and safety	https://youtu.be/vQ5HrubRYVo?si=7x8McU_4HuL7jwjp	NPTEL (IIT Madras)
	Radioactive waste	https://youtu.be/qYDjjJxc4h4	e-pathshala
Unit-III	Nuclear power production cycle	https://youtu.be/jAmrYtcknMc	NPTEL (IIT Madras)
	Nuclear reactor and safety	https://youtu.be/vQ5HrubRYVo?si=0b1pkcjiUcDMjfa_	NPTEL (IIT Madras)
Unit-IV	Radiological protection	https://youtu.be/EzxZCgcLtqk	NPTEL (IIT Madras)
	Safety practices in NPP	https://youtu.be/k2NOPsYw6i0	NPTEL (IIT Madras)

Course Code	**PEC-FT-328A**				
Category	Professional Elective Courses				
Course Title	**Computational Fluid Dynamics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To familiarize students with numerical methods and discretization techniques used for solving fluid flow and fire dynamics problems. • To develop understanding of governing equations used in computational fluid dynamics such as continuity, momentum, and energy equations. • To enable students to analyze smoke propagation, heat transfer, ventilation, and fire behavior in buildings using CFD tools. • To develop the ability to interpret CFD simulation results for improving fire safety design and risk assessment in industrial and building environments.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the concepts related to fluid mechanics and heat transfer used in computational fluid dynamics (CFD).	Level 1: Remember
CO2	Understand the principles of numerical methods, turbulence models and CFD applications in fire and smoke movement analysis.	Level 2: Understand
CO3	Apply CFD software and simulation techniques to model fire scenarios, smoke propagation, and heat transfer problems in fire safety engineering.	Level 3: Apply
CO4	Analyze CFD simulation results to evaluate fire behavior, smoke control performance in buildings and industrial facilities.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Impact and application of CFD in diverse fields, Governing equation of fluid dynamics, Continuity, Momentum and energy, Generic integral form for governing equations, Initial and boundary conditions, Governing equation for boundary layers, Classification of partial differential equations, Hyperbolic, Parabolic, Elliptic and mixed types, Applications and relevance.

Unit-II

Basic Aspects of Discretization: Discretization techniques, Finite difference, Finite volume and finite element method, Comparison of discretization by the three methods, Introduction to finite differences, Transient one-dimensional and two-dimensional conduction, Explicit, Implicit, Crank-nicolson, ADI scheme, Stability criterion.

Difference Equations: Numerical errors, Grid independence test, Optimum step size.

Unit-III

Grid Generation: General transformation of the equation, Form of the governing equations suitable for CFD, Boundary fitted co-ordinate systems, Elliptic grid generation, Adaptive grid, Modern developments in grid generation.

Unit-IV

Steady One-Dimensional Convection and Diffusion: Central difference, Upwind, Quick, Exponential, False diffusion, Hybrid and power law schemes, Transient one dimensional heat conduction equation.

Representation of the Pressure Gradient Term and Continuity Equation: Staggered grid, Momentum equation, Pressure and velocity correction, Pressure correction equation, Numerical procedure for SIMPLE algorithm, Boundary condition for the pressure correction method, Stream function, Vorticity method, Discussion of case studies.

Suggested Readings:

- An Introduction to Computational Fluid Dynamics by H. Versteeg, W. Malalasekra, The Finite Volume Method (2nd Edition), Prentice Hall. (2007)
- Computational Fluid Dynamics by Sreenivas Jayanti, Springer (2016)
- Introduction to Computational Fluid Dynamics by Pardip Niyogi, S.K. Chakrabarity, M. K. Laha, Person India (2005)
- Computational Fluid Dynamics and Heat Transfer by S.Thanigaiarasu, Techsar Pvt. Ltd. (2020)
- Computational Fluid Dynamics by Young-II Lim, MDPI (2021)

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Governing equation of Fluid Dynamics	https://youtu.be/AZknqweSR9w?si=U5atrcPzCqxjTUtC	NPTEL (IIT Madras)
	Partial Differential Equation	https://youtu.be/W2DvB1R6uJc?si=LCEN4sCr4NHDupdE	NPTEL (IIT Madras)
Unit-II	Finite Differences	https://youtu.be/j-Hpi1zd2fk?si=gxbUs2qurVY4Kso7	NPTEL (IIT Madras)
	Numerical Errors	https://youtu.be/UFg_yhh5nRU?si=wJpzAsoa9y4pzuTo	NPTEL (IIT Madras)
Unit-III	Introduction to Grid Generation	https://youtu.be/LY215hdSFd4?si=fIqpzYPQWiBKfSIS	NPTEL (IIT Kharapur)
	Boundary Fitted Co-ordinate System	https://youtu.be/mHD3pFoUXD0?si=EYJntXxNg2plniHy	NPTEL (IIT Kharapur)
Unit-IV	Steady One Dimensional Convention, upwind	https://youtu.be/UFg_yhh5nRU?si=wJpzAsoa9y4pzuTo	NPTEL (IIT Madras)
	Numerical Procedure for SIMPLE Algorithm	https://youtu.be/S28FrU_xZ24?si=USOrI3XsQ9Pn0mMB	NPTEL (IIT Madras)

Course Code	**OEC-07A**				
Category	Open Elective Courses				
Course Title	**Computer Aided Risk Analytics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to hazard identification, risk assessment techniques and safety management practices used in industrial systems. • To develop understanding of quantitative risk analysis, reliability concepts and computer aided safety analysis tools. • To familiarize students with risk control strategies, human factors engineering and occupational safety practices for industrial environments. • To provide knowledge of accident investigation methods, stochastic safety modelling and advanced applications of computer aided safety engineering.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the terminology related to hazard identification, risk analysis, safety engineering, and computer-aided safety tools.	Level 1: Remember
CO2	Explain the principles of risk assessment, safety engineering, human factors, accident analysis, and computer-aided risk analysis.	Level 2: Understand
CO3	Apply risk assessment techniques, safety engineering principles, and computer-aided tools to industrial safety problems.	Level 3: Apply
CO4	Analyze industrial risks, accident scenarios, and safety performance using quantitative and computer-aided risk analysis techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit–I

Hazard Identification and Risk Assessment: Introduction to hazard, risk and safety, Concepts of hazard identification and risk assessment, Risk perception and risk acceptance criteria, Principles of risk management, Accident causation theories, Hazard monitoring and control techniques, Safety audits and management system audits, Safety checklists and inspection procedures, Material Safety Data Sheets (MSDS), Preliminary hazard analysis, What-if analysis, Event Tree Analysis (ETA), Fault Tree Analysis (FTA), Hazard and Operability Study (HAZOP), Coarse hazard analysis, Human error analysis, Hazard warning systems and plant safety review methods.

Unit–II

Quantitative and Computer Aided Risk Analysis Techniques: Basic concepts of quantitative and qualitative risk analysis, Probability theory and Boolean algebra, Reliability engineering fundamentals, Quantitative Risk Assessment (QRA), Consequence analysis methods, Fire and explosion modelling, Toxic gas dispersion modelling, Thermal radiation and overpressure estimation, Failure Mode and Effect Analysis (FMEA), Criticality analysis, Layer of Protection Analysis (LOPA), Safety Integrity Level (SIL), Principles and applications of computer aided risk analysis software, Introduction to PHAST, SAFETI, EFFECTS, HAZAN and FETI software tools, Applications of modelling and simulation in industrial safety analysis.

Unit–III

Risk Control, Human Factors and Safety Engineering: Risk control and mitigation strategies, Property damage and loss estimation, Human reliability and behavioural safety, Man-machine systems, Job and personal risk factors, Safety standards and guidelines, Selection and training of personnel, Ergonomics and workplace design, Anthropometric considerations, Body posture and body dimension analysis, Adjustment range and posture evaluation, Methods for reducing posture strain, Human-machine interface design, Types of controls and displays, Control-display compatibility, Fatigue, stress and vigilance, Performance enhancement strategies, Occupational health and industrial hygiene practices.

Unit–IV

Accident Analysis, Stochastic Modelling and Advanced Applications: Accident and incident investigation techniques, Collection and analysis of accident data, Legal requirements for accident reporting, Statistical analysis of safety data, Computer applications in accident analysis and prediction, Fire growth and stochastic risk models, Response surface methods, Estimation of untenable conditions during fire, Carbon monoxide exposure and COHb analysis, Reliability index calculations, Emergency planning and disaster management, Risk communication and safety reporting, Applications of artificial intelligence and machine learning in safety engineering, Cyber safety in industrial systems, Case studies of industrial disasters and lessons learned, Recent trends in computer aided risk analysis and safety management systems.

Suggested Readings:

- Guidelines for Hazard Evaluation Procedures by AIChE/CCPS, Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York
- Guidelines for Chemical Process Quantitative Risk Analysis by AIChE/CCPS, Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York
- Loss Prevention in the Process Industries by F. P. Lees, Butterworths, London
- Accident Prevention Manual for Business and Industry, Vol. I by National Safety Council, USA
- Process Safety Analysis – An Introduction by Bob Skelton, Gulf Publishing Company, Houston, Texas
- Safety Analysis: Principles and Practices in Occupational Safety by Lars Harms-Ringdahl, CRC Press
- Safety at Work by John Channing, Routledge Taylor & Francis Group, London and New York
- Risk Analysis in Building Fire Safety Engineering by A. M. Hasofer, V. R. Beck and I. D. Bennetts, Elsevier
- Practical Hazops, Trips and Alarms by David Macdonald, Elsevier

Course Code	**OEC-08A**				
Category	Open Elective Courses				
Course Title	**Health, Safety and Environment**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the fundamentals of health, safety and environmental management in industrial and engineering workplaces. • To develop understanding of industrial hazards, risk assessment methods and safety management practices for accident prevention. • To familiarize students with environmental protection measures, pollution control techniques and sustainable development practices. • To provide knowledge of occupational health regulations, safety standards and modern HSE management systems used in industries.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the terminology related to health, safety, environment, risk management, and HSE regulations.	Level 1: Remember
CO2	Explain the principles of occupational health, industrial safety, environmental protection, and HSE management systems.	Level 2: Understand
CO3	Apply HSE principles, risk management techniques, and safety regulations to industrial workplaces.	Level 3: Apply
CO4	Analyze workplace hazards, environmental impacts, and HSE management practices to recommend appropriate control measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Health, Safety and Environment: Introduction to health, safety and environment, Importance of HSE in engineering industries, Concepts of hazard, risk, accident and incident, Safety terminology and principles, Occupational health and hygiene, Industrial health hazards, Physical, chemical, biological and ergonomic hazards, Occupational diseases and prevention methods, Safety signs and symbols, Personal protective equipment (PPE), Safety culture and safety management systems, Roles and responsibilities of employees and employers, Accident causation theories, Accident investigation and reporting techniques.

Unit-II

Industrial Safety and Risk Management: Principles of industrial safety, Hazard identification and risk assessment techniques, Job safety analysis, Permit to work system, Machine safety and guarding, Electrical safety, Fire hazards and fire prevention methods, Fire detection and suppression systems, Material handling safety, Construction safety, Confined space safety, Work at height safety, Safety in welding and cutting operations, Chemical handling and storage safety, Emergency preparedness and response planning, Industrial disaster management, First aid and basic life support.

Unit-III

Environmental Protection and Sustainability: Introduction to environmental science and ecology, Environmental pollution and its types, Air pollution, Water pollution, Soil pollution, Noise pollution and thermal pollution, Sources, effects and control measures of pollution, Solid waste management, Hazardous waste management, Biomedical and e-waste management, Environmental impact assessment (EIA), Environmental legislation and standards, Sustainable development, Green technologies, Renewable energy resources, Climate change and global warming, Carbon footprint and energy conservation, Environmental monitoring and auditing.

Unit-IV

Occupational Health, Safety Regulations and Management Practices: Occupational health and safety management systems, Safety audits and inspections, Safety training and awareness programs, Industrial laws and regulations related to health, safety and environment, Factories Act, Environmental Protection Act, Occupational safety standards, ISO 14001 and ISO 45001, Ergonomics and workplace design, Stress management and mental health at workplace, Human factors in industrial safety, Emergency evacuation procedures, Disaster management planning, Public health and community safety, Corporate social responsibility in HSE, Recent trends in industrial health, safety and environmental management.

Suggested Readings:

- Industrial Safety Management by L. M. Deshmukh, Tata McGraw Hill Publishing Company
- Safety Engineering by Dr. D. Udayakumar and Dr. P. Kalyanasundaram, Scitech Publications
- Environmental Engineering by Peavy, Rowe and Tchobanoglous, Tata McGraw Hill
- Occupational Health and Safety Management by Charles D. Reese, CRC Press India
- Health, Safety and Environment Management by R. K. Jain and Sunil S. Rao, Khanna Publishers
- Industrial Safety, Health and Environment Management Systems by R. K. Jain and Sunil S. Rao, Khanna Publishers, New Delhi
- Fundamentals of Environmental Engineering by D. D. Mishra, S. Chand & Company
- Environmental Pollution and Control Engineering by C. S. Rao, New Age International Publishers
- Industrial Safety and Environment by Amit Gupta, University Science Press
- Safety, Health and Environment by Satish Tiwari, Oxford University Press India
- Handbook of Occupational Safety, Health and Environment by K. V. S. Murali Krishna, Universities Press
- Environmental Studies by Benny Joseph, Tata McGraw Hill Education
- Industrial Health and Safety Management by M. P. Poonia and S. C. Sharma, Khanna Publishers
- Fire Prevention and Industrial Safety by R. P. Khandpur, Khanna Publishers
- Safety Management in Industry by N. V. Krishnan, Jaico Publishing House

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations

(Under NEP-2020)

B-SCHEME

Common for B.Tech (Fire Technology and Safety)
and
B.Tech (Fire Technology and Safety- Working Professionals)

Effective from

Academic Session 2026-27 (From 2nd Year onwards)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	1 Practical (P) per week	0.5 Credit
4	2 Practical (Lab) per week	1 Credit

2. RANGE OF CREDIT

A range of credits from 160 to 170 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Basic Science Courses	21
2	Engineering Science Courses	21
3	Professional Core Courses	72
4	Professional Elective Courses (Relevant to chosen specialization/branch)	15
5	Indian Knowledge System	-
6	Open Electives Courses	9
7	Humanities and Social Sciences including Management courses	12
8	Project work, seminar and internship in industry or appropriate work place/ academic and research institutions in India/abroad	17
9	Value Added Courses	03
10	Mandatory Non Credit Courses – Audit Course	(Non-Credit)
	Total Credits	**170***

**Minor variation is allowed as per need of the programme.*

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Basic Science Courses	BSC
2	Engineering Science Courses	ESC
3	Professional Core Courses	PCC
4	Professional Elective Courses (Relevant to chosen specialization/branch)	PEC
5	Indian Knowledge System	IKS
6	Multidisciplinary Open Electives Courses	OEC
7	Humanities and Social Sciences including Management courses	HSMC
8	Laboratory Courses	LC
9	Mandatory Non-Credit Courses (Audit Course)	MC
10	Project	PR
11	Internship/ Practical Training/ Seminar	INT

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

Common for B.Tech (Fire Technology and Safety) – 3rd Semester

and

B.Tech (Fire Technology and Safety- Working Professionals) – 3rd Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Basic Science Courses	BSC –FT-201B	Engineering Mathematics-III	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	PCC-FT-203B	Fire Engineering	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	PCC-FT-205B	First Aid and Paramedics	3	0	0	3	3	30	45		75	3
4	Professional Core Courses	PCC-FT-207B	Principles of Safety Management	3	0	0	3	3	30	45		75	3
5	Professional Core Courses	PCC-FT-209B	Fire Appliances and Rescue Equipments	3	0	0	3	3	30	45		75	3
6	Engineering Science Courses	ESC-ME-211B	Heat, Mass Transfer and Thermodynamics	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-PCC-FT-213B	Fire Engineering Lab	0	0	2	2	1	10		15	25	3
8	Professional Core Courses	LC-PCC-FT-215B	First Aid and Paramedics Lab	0	0	2	2	1	10		15	25	3
9	Engineering Science Courses	LC-ESC-FT-217B	Heat, Mass Transfer and Thermodynamics Lab	0	0	2	2	1	10		15	25	3
10	Professional Core Courses	LC-PCC-FT-219B	Fire Ground Operations-III	0	0	2	2	1	10		15	25	3
11	Mandatory Courses	MC-201B	Environmental Science	2	0	0	2	0	20	30		50*	3
Total Credits								**23**				**575**	

Note:

I. MC-201B is a mandatory non–credit course in which students will be required to obtain passing marks in theory. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in detailed marks certificate of student.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

Common for B.Tech (Fire Technology and Safety) – 4th Semester

and

B.Tech (Fire Technology and Safety- Working Professionals) – 4th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-FT-202B	Structural Fire Engineering	3	0	0	3	3	30	45		75	3
2	Professional Core Courses	PCC-FT-204B	Fire Protection	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	PCC-FT-206B	Fluid Mechanics and Fire Service Hydraulics	3	0	0	3	3	30	45		75	3
4	Professional Core Courses	PCC-FT-208B	Industrial Hygiene and Occupational Health	3	0	0	3	3	30	45		75	3
5	Professional Core Courses	PCC-FT-210B	Electric Fire Safety Practice and Standards	3	0	0	3	3	30	45		75	3
6	Professional Elective Courses	Refer Table-I	Professional Elective-I	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-PCC-FT-212B	Structural Fire Engineering Lab	0	0	2	2	1	10		15	25	3
8	Professional Core Courses	LC-PCC-FT-214B	Fire Protection Lab	0	0	2	2	1	10		15	25	3
9	Professional Core Courses	LC-PCC-FT-216B	Fire Service Hydraulics Lab	0	0	2	2	1	10		15	25	3
10	Professional Core Courses	LC-PCC-FT-218B	Industrial Hygiene and Occupational Health Lab	0	0	2	2	1	10		15	25	3
11	Professional Core Courses	LC-PCC-FT-220B	Fire Ground Operations-IV	0	0	2	2	1	10		15	25	3
							Total Credits	**23**				**575**	

Notes:

I. At the end of 4th semester each student has to undergo Practical Training based on Fire and Safety/ Fire and Safety Equipments Installation, Care and Maintenance/Fire and Safety Audits/Any Certificate Course related to Fire and Safety (Min Contact Hours must be 30 Hrs) of 4/6 weeks in Fire Service Department/Industry/ Multi-Speciality Hospital/Professional Organization/ Research Laboratory/ Training Centre/ Educational Institute/other building Occupancy having Fire Fighting Installations etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

II. **For Working Professionals:** Submit a Training/Project report of their work in their respective company/Organization for the period of summer training/industrial training for evaluation. The evaluation shall be carried out in the 5th Semester.

III. Choose any one from Professional Elective-I

IV. Students can take Massive Open Online Courses (MOOCs) approved by the concerned Chairperson Board of Studies (BoS). The doubt classes will be conducted of 1 hour per week. The students may opt for examinations from the Institute or from the concerned portal.

Table 1 Professional Elective – I

Sr. No.	Code	Subject
1	PEC-FT-222B	Industrial Psychology
2	PEC-FT-224B	Chemical Process Safety
3	PEC-FT-226B	Environmental Engineering and Management
4	PEC-FT-228B	Special Fire Hazards
5	----------	Any one MOOCS/Swayam Course

<table>
<tr><td>Course code</td><td colspan="5">BSC-FT-201B</td></tr>
<tr><td>Category</td><td colspan="5">Basics Science Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Engineering Mathematics-III</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To develop the understanding of students regarding partial differential equations, numerical methods, transform calculus, and statistical techniques used in Fire Engineering analysis.
To familiarize the students with analytical and computational methods for solving differential equations, interpolation problems, numerical integration, and optimization models.
To make the students learn Laplace transform techniques, hypothesis testing procedures, and linear programming methods for mathematical problem solving.
To make the students familiar with the application of mathematical tools and numerical techniques in Fire Engineering and scientific computations.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the concepts related to partial differential equations, numerical methods, Laplace transforms, linear programming, and statistical testing techniques.	Level 1: Remember
CO2	Explain the methods of solving partial differential equations, interpolation problems, numerical integration techniques, Laplace transform problems, and hypothesis testing procedures.	Level 2: Understand
CO3	Solve engineering and scientific problems using partial differential equations, interpolation techniques, numerical integration methods, and numerical solution procedures.	Level 3: Apply
CO4	Apply Laplace transform methods, linear programming techniques, and statistical testing procedures for solving engineering optimization and data analysis problems.	Level 3: Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Partial Differential Equations: First order linear partial differential equations, First order non-linear partial differential equations, Charpit's method, Second order linear partial differential equations and their classifications, Method of separation of variables and its applications to wave equation, One dimensional heat equations and two dimensional heat flow (steady state solutions only)

Unit-II

Numerical Methods: Solution of polynomial and transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit-III

Transform Calculus: Laplace Transforms and its Applications, Laplace transforms of elementary functions, properties of Laplace transforms, existence conditions, transforms of derivatives, transforms of integrals, Multiplication by t^n, Division by t, Evaluation of integrals by Laplace transforms, Laplace transform of unit step function, unit impulse function and periodic function, inverse transforms, convolution theorem, application to linear differential equations.

Unit-IV

Linear Programming: Linear programming problems formulation, solving linear programming problems using (i) Graphical method (ii) Simplex method (iii) Dual simplex method.

Testing of Hypothesis: Testing of hypothesis, Tests of significance for large samples, Student's t-distribution (applications only), Chi-square test of goodness of fit.

Suggested Readings:

- Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publishing Company Limited
- Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers
- Numerical Methods by P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand and Company
- Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning.
- A Textbook of Engineering Mathematics by N. P. Bali and Manish Goyal, Laxmi Publications.

Useful Video Links:

Unit No.	Topic	Link	Source
Unit -I	One Dimensional Heat Equation	https://youtu.be/GmIcbqdvIgc?si=4XnsNAbmcXVgE5ur	**IIT Roorkee**
Unit-II	Solution by Separation of Variables	https://youtu.be/W3HXK1Xe4nc?si=aqwoXZcWjcdiWifm	**IIT Kharagpur**
	Bisection Method	https://youtu.be/3FhE9De2__o?si=LM8q56foPk4yBvDb	**IIT Madras**
	Newton-Raphson Method	https://www.youtube.com/watch?v=ZcbFQz_Kwog	**IIT Madras**
	Introduction to numerical differentiation interpolation formula	https://www.youtube.com/watch?v=bnUsBhPLekE	**IIT Roorkee**
	Divided Difference interpolation	https://www.youtube.com/watch?v=DnfC0IUmUe4	**IIT Roorkee**

Unit-III	Laplace Transform	https://www.youtube.com/watch?v=c9NibpoQjDk	**IIT Madras**
	Laplace Transform & its existence	https://www.youtube.com/watch?v=2LyY4t0Gfvs	**IIT Kharagpur**
	Properties of Laplace Transform-Part-1	https://www.youtube.com/watch?v=SN0dcSyoJIE	**IIT Madras**
	Properties of Laplace Transform-Part-2	https://www.youtube.com/watch?v=MV3a-sQqDRc	**IIT Madras**
	Convolution Theorem for Laplace Transfroms	https://www.youtube.com/watch?v=niOMKg9FMO8	**IIT Madras**
Unit-IV	Simplex Method	https://www.youtube.com/watch?v=RcPhmPhjMbc	**IIT Kharagpur**
	Testing of Hypothesis-Basic Concepts	https://www.youtube.com/watch?v=IEP3swFeauE	**IIT Kharagpur**
	Testing of Hypothesis-I	https://www.youtube.com/watch?v=14PQawp_rjk	**IIT Kharagpur**
	Chi-Square Distribution	https://www.youtube.com/watch?v=lQ1ec1nQvKM	**IIT Madras**

<table>
<tr><td>Course Code</td><td colspan="5">PCC-FT-203B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Fire Engineering</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To make the students learn the fundamentals of fire science, combustion behaviour, fire development mechanisms, and the effects of heat and smoke during fire incidents.
To familiarize the students with fire prevention principles, building fire safety requirements, structural fire protection measures, and fire safety standards used in different occupancies.
To develop the understanding of students regarding fire protection systems, fire detection and alarm systems, extinguishing agents, and inspection and maintenance practices for fire safety equipment.
To acquaint the students with industrial fire hazards, explosion phenomena, emergency response procedures, firefighting strategies, rescue operations, and recent developments in fire engineering.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the key terminologies related to fire science, combustion, fire behaviour, fire prevention, fire protection systems, industrial fire hazards and emergency response practices.	Level 1: Remember
CO2	Explain the principles of combustion, fire development, smoke movement, building fire safety, fire protection systems and industrial firefighting practices.	Level 2: Understand
CO3	Apply fire prevention methods, fire safety standards, firefighting techniques, emergency response procedures and fire protection system practices for different fire scenarios.	Level 3: Apply
CO4	Analyze fire behaviour, industrial fire and explosion hazards, smoke movement, fire protection system performance and emergency management strategies for effective fire safety planning.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit–I

Fundamentals of Fire Science and Fire Behaviour: Introduction to fire engineering, Scope and importance of fire engineering, Introduction to NBC, NBCS, IS, NFPA and OISD fire safety standards, Fire, Fire triangle and fire tetrahedron, Classification of fires and combustible materials, Physical and chemical properties of fuels, Flash point, Fire point and Auto-ignition temperature, Fundamentals of combustion, Types of combustion, Ignition and ignition sources, Limits of flammability, Fire causation theories, Electrical fire hazards and electrical safety, Static electricity and lightning protection, Basic stoichiometry of combustion, Fire load and fire severity, Stages of fire development, Fire spread and fire behaviour, Smoke and products of combustion, Smoke production and movement, Smoke density and visibility, Toxicity of smoke and fire gases, Effects of heat and smoke on human body, Principles of fire extinguishment.

Unit–II

Fire Prevention and Building Fire Safety: Principles of fire prevention, Fire hazards and fire risk assessment, Fire safety practices and housekeeping, Electrical fire hazards and electrical safety, Static electricity and lightning protection, Storage and handling of flammable and combustible materials, Classification of buildings based on occupancy as per NBCS, Fire prevention in various occupancies, Fire resistant construction and structural fire protection, Compartmentation and fire barriers, Fire doors and dampers, Means of egress and evacuation requirements, Exit systems, Staircases and refuge areas, Smoke control and pressurization systems, Fire safety audit and inspection procedures.

Unit–III

Fire Protection Systems and Equipment: Active and passive fire protection systems, Water as extinguishing agent, Fire water supply systems, Fire hydrant systems, Hose reels and hose cabinets, Fire pumps, Portable fire extinguishers and extinguishing agents, Foam fire protection systems, Dry chemical powder systems, CO_2 and clean agent systems, Automatic sprinkler systems, Water spray and deluge systems, Fire detection and alarm systems, Smoke, Heat and Flame detectors, Conventional and addressable fire alarm systems, Public address and emergency communication systems, Selection, Installation, Inspection, testing and maintenance of fire protection systems.

Unit–IV

Industrial Fire Safety and Emergency Response: Industrial fire hazards and process fire safety, Fire and explosion hazards in industries, BLEVE, UVCE and dust explosions, Fire safety in oil and gas Industries, Chemical and petrochemical industries, Power plants and warehouses, Fire safety in storage tanks and pipelines, Grounding and bonding, Incident Command System (ICS), Firefighting organization and strategy, Breathing apparatus and personal protective equipment, Rescue and evacuation techniques,Ventilation, Salvage operation, Ropes, Lines, Ladders, Emergency response planning and disaster management, Post-Fire investigation and reporting, Case studies of major industrial fires and explosions, Recent developments in fire engineering and smart fire safety systems.

Suggested Readings:

- Manual of Firemanship by HMSO
- Fire Safety in Buildings by V K Jain, New Age publishers, New Delhi
- Principles of Fire Safety Engineering by A. K. Das, PHI Publishers.
- Fundamentals of Fire Safety in Building Design by Dr. Than Singh Sharma, Aayush Publications, New Delhi
- Handbook of Fire Technology by R.S.Gupta, Orient Longman Pvt. Ltd., Kolkata
- Manual of Fire Safety by N. Sesha Prakash, CBS Publishers & Distributors Pvt. Ltd.
- National Building Code (NBC) Part-4 Life and Safety (2016- Edition)- Bureau of Indian Standards
- National Building Construction Standards-2026, Part F, Bureau of Indian Standards

- Fire Protection and Prevention: The Essential Handbook by Barendra Mohan Sen, UBS Publishers and Distributors, New Delhi

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Basics of Fire-Part 1	https://youtu.be/eLeZ2zc2hgI?si=VeWVsuhIkwRf-XYd	NPTEL (IIT Madras)
	Basics of Fire-Part 2	https://youtu.be/NzIbiOAJONc?si=7H_mIiQm18vvULrd	NPTEL (IIT Madras)
	Combustion	https://youtu.be/n6HAyxdup_U?si=IMSS2Ye7w01SQQNz	NPTEL (IIT Delhi)
Unit-II	Emergency Scene Management (ESM)	https://youtu.be/uibCRbELVbA?si=z9JrmlCfMjKvDR4g	NPTEL (IIT Kanpur)
	Safety practices for Fire protection	https://youtu.be/-XRu7BSouvY?si=ogFdjHXtUbAbHWly	NPTEL (IIT Madras)
Unit-III	Fire safety: Internal planning, Detection and Suppression	https://youtu.be/e3Orj5XDj2M?si=YghWp5QRE9ECcIKA	NPTEL (IIT Delhi)
	Sprinklers I	https://youtu.be/ZKsqIPM810M?si=5uIMn1w6so-tb7oU	NPTEL (IIT Roorkee)
	Sprinklers II	https://youtu.be/Z82ypLX2gn8?si=bdPqswwPWQ-DB613	NPTEL (IIT Roorkee)
Unit-IV	Fire Safety: Escape and Refuge	https://youtu.be/O6CYQt9vi_Y?si=D-3_DCTnQ3fF6Bxm	NPTEL (IIT Delhi)
	Ventilation	https://youtu.be/K58rDFPGJO0?si=b4r8Lxa3UgPiMnNZ	NPTEL (IIT Delhi)

Course Code	**PCC-FT-205B**					
Category	Professional Core Courses					
Course Title	**First Aid and Paramedics**					
Scheme and Credits	L	T	P	**Credits**	**Semester-III**	
	3	0	0	**3**		
Course Objectives	The objectives of this course are ● To make the students familiar with the fundamentals of first aid, emergency care procedures, cardiopulmonary resuscitation, and basic life support techniques. ● To develop the understanding of students regarding the structure and functions of the human body, types of wounds and injuries, and appropriate first aid management methods. ● To familiarize the students with medical emergencies, environmental injuries, poisoning, bites, burns, and emergency response procedures for different casualty conditions. ● To make the students learn casualty handling methods, ambulance services, accident management procedures, rescue techniques, and disaster response practices.					
Assessment	30 Marks					
End Semester Examination	45 Marks					
Total	75 Marks					
Duration of Exam	03 Hours					

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	Define the terms related to first aid, emergency care, human body systems, wounds, injuries, medical emergencies, casualty handling, accidents and disaster management.	Level 1: Remember
CO2	Explain the concepts of first aid and emergency, human body, injury and wound management, fracture care, medical conditions, causality handling and accidents management.	Level 2: Understand
CO3	Apply first aid and other techniques for managing injuries, wound and medical emergencies, causalities and accidents.	Level 3: Apply
CO4	Analyze emergency situations, injury conditions, accident scenarios, and medical cases to determine appropriate first aid measures, rescue procedures and emergency response actions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of First Aid and Emergency Care: Introduction to first aid, Principles of first aid, Role and responsibilities of first aider, General rules of first aid, Sequence of actions at emergency scene, First Aid kit and its contents, Vital signs- A, B, C (Airway, Breathing and Circulation) and patient assessment,

Cardiopulmonary Resuscitation (CPR), Artificial respiration, Recovery position, Emergency action procedures, Basic Life Support (BLS), Transportation of casualties, Training and ethics in first aid.

Unit-II

Human Body: Study of the human body and its various systems such as musculoskeletal system, Respiratory system, Circulatory system, Digestive system, Central nervous system etc.
Wounds: Wound, Types, Management, Bleeding and its types, Control of bleeding.
Injuries: Injuries, First Aid for various injuries, Soft tissue injuries, Head injuries, Chest injuries, Eye injuries and blindness, Burn and its types, Rule of Nine, Electrical injuries, Fractures and Dislocations, Sprains and Strains, Bandages and Slings, Immobilization techniques.

Unit-III

Medical Emergencies and Environmental Injuries: Heart attack and Angina, Stroke and Hypertension, Diabetes mellitus, Hyperglycemia and Hypoglycemia, Seizures and Epilepsy, Fever and Meningitis, Fainting and Shock, Allergy and Anaphylaxis, Headache and Migraine, Earache and Toothache, Abdominal pain, Vomiting and Diarrhea, Poisoning and Toxic Exposure, Snake bite, Dog bite and Insect bite, Drowning and Choking, Unconsciousness, Frostbite and Heat stroke, Childbirth emergencies, Protection of body from extreme weather conditions.

Unit-IV

Casualty Handling and Ambulance Services: Handling and transportation of casualties, Lifting techniques and rescue methods, Stretchers and their types, Ambulance services and patient transportation, Minor illness management**.**
Accident Management: Accidents and their types, Accident reporting and record keeping, Accident investigation procedures, Medical history assessment, Observation of signs and symptoms, Preparation of diagnosis reports, Duties and responsibilities of paramedics, Communication during emergencies, Disaster and mass casualty management, Safety precautions during rescue operations.

Suggested Readings:

- Manual of first aid to the injured by St. John Ambulance Association.
- First aid text book by American National Red Cross
- Manual of First aid instruction by US Bureau of Mines
- Accident First Aid by V.V. Yudenich, Mir Publishers, Moscow

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Basic Life Support (BLS)-Part 1 by NPTEL	https://www.youtube.com/watch?v=LAJJDH5ol4M	NPTEL (IIT Madras)
	Basic Life Support (BLS) - Part 2 by NPTEL	https://www.youtube.com/watch?v=kYZvMk88zx4	NPTEL (IIT Madras)
	CPR	https://www.youtube.com/watch?app=desktop&v=BQNNOh8c8ks	St. John Ambulance
Unit-II	Circulatory System	https://www.youtube.com/watch?v=b0bOclBpyME	NPTEL (IIT Guwahati)
	Muscular System	https://www.youtube.com/watch?v=ijiEeazaotE	NPTEL (IIT Guwahati)
	Respiratory System	https://www.youtube.com/watch?v=974jAldy8JY&t=5s	SWAYAM (IIT Madras)

	Head Injury	https://www.youtube.com/watch?v=a4cIFZx1f2E	St. John Ambulance
Unit-III	Stroke- Signs & Symptoms	https://www.youtube.com/watch?v=PhH9a0kIwmk	St. John Ambulance
	Diabetic Emergency	https://www.youtube.com/watch?v=L06DNMRcy98&t=144s	St. John Ambulance
Unit-IV	How to Treat a Fracture & Fracture Types	https://www.youtube.com/watch?v=2v8vlXgGXwE	St. John Ambulance
	Accident Investigation, Reporting	https://www.youtube.com/watch?v=VhuZ6M7a8N8	NPTEL (IIT Kharagpur)

Course Code	**PCC-FT-207B**				
Category	Professional Core Courses				
Course Title	**Principles of Safety Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce students to the fundamentals of safety management, accident prevention principles and industrial safety practices. • To develop understanding of hazard identification, risk assessment and hazard control techniques used in industries. • To familiarize students with safety training methods, accident investigation procedures and occupational safety management systems. • To provide knowledge of safety auditing, performance evaluation techniques and industrial safety compliance practices.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe safety management, hazards, risks, accidents, safety culture, training, PPEs, safety audits and industrial safety practices.	Level 1: Remember
CO2	Explain hazard identification methods, risk assessment techniques, safety training procedures, accident investigation methods and safety management systems used in industries.	Level 2: Understand
CO3	Apply hazard control measures, permit to work systems, safety training techniques, safety auditing procedures and performance evaluation techniques for industrial safety management.	Level 3: Apply
CO4	Analyze safety performance indicators, human factors, accident causes, audit findings and compliance practices for improvement of industrial safety management systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Safety Management: Introduction to safety and safety management, Integration of health safety and environment, safety and productivity, points for consideration of safety, general instructions for safety, objectives and principles of safety management, concepts of hazard, risk and accident, accident causation theories, accident prevention principles, direct and indirect cost of accidents, introduction to PPEs, safety culture and safety climate, roles and responsibilities of management, supervisors, workers and safety professionals in industrial safety management.

Unit-II

Hazard Identification and Risk Control: Hazard Identification and Risk Assessment (HIRA), Job Safety Analysis (JSA), risk assessment techniques, hierarchy of hazard control measures, permit to work systems, contractor safety management, safety in plant operation and maintenance, behaviour-based safety, safety communication and reporting systems, emergency preparedness and response planning.

Unit-III

Safety Training, Investigation and Safety Management Systems: Safety education and training, Elements of training cycle, objectives and methods of safety training, behaviour-oriented training techniques, Safety communication and awareness, causes of preventable injuries, safety awareness programs, accident and incident investigation procedures, root cause analysis, reporting and documentation systems, safety committees and their functions, elements of Safety Management Systems (SMS), overview of ISO 45001 occupational health and safety management systems.

Unit-IV

Safety Auditing and Performance Evaluation: Safety audits and inspection systems, types and procedures of safety audits, responsibilities of audit team, safety surveys and safety observation techniques, safety performance measurement and indicators, frequency rate, severity rate, incidence rate and Safe-T-Score, safety benchmarking and continuous improvement, principles of safety in design and engineered safety, human factors in safety, safety legislation overview and industrial safety compliance practices.

Suggested Readings

- Fundamentals of Industrial Safety & Health by K.U. Mistry, Siddharth Prakashan.
- Industrial Safety Health and Environment management Systems by Jain and Rao, Khanna Publishers
- Safety Management by R.K. Mishra- AITBS Publishers.
- Safety Management in Industry by N.V. Krishnan, Jaico Publishing House, 1997
- Industrial Safety by Ronald P. Blake, Prentice Hall, New Delhi, 1973
- Occupational Safety and Health by David L. Goetsch, Prentice Hall
- Modern Accident Investigation and Analysis by Ted S. Ferry, John Wiley & Sons

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Accident, Accident Investigation	https://youtu.be/VhuZ6M7a8N8?si=AJ0gXnTGKOd9KPFK	NPTEL (IIT Kharagpur)
	Safety Engineering & Accident causing mechanisms	https://youtu.be/91YpCY-1Fy0?si=4L5f1y_NiOLGSm-4	NPTEL (IIT Kharagpur)
	Personal Protective Equipment	https://youtu.be/eLnv6Eb2Pq0?si=cbAkgLUqZ9QEJoWQ	NEPTEL (IIT Delhi)
	Safety Committee Meeting	https://youtu.be/N12BEnI1hCY?si=TdR-4HO58IZsM5mp	NPTEL- IITC
Unit-III	Safety Education	https://youtu.be/v-eltsixu4I?si=2T9UetPJdllhk7YN	NPTEL (IIT Kharagpur)
Unit-IV	Safety Audit	https://youtu.be/HuYIDi0QQm8?si=y_vJEkJHAVaP81WS	NPTEL (IIT Kharagpur)
	Safety Performance Indicators	https://youtu.be/NI89F0ISMog?si=sxTayTaCNV23t7a1	NPTEL (IIT Kharagpur)

Course Code	**PCC-FT-209B**				
Category	Professional Core Courses				
Course Title	**Fire Appliances and Rescue Equipments**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To make the students familiar with different types of fire appliances, firefighting vehicles, fire pumps and associated operational systems used in fire services. • To develop the understanding of students regarding firefighting equipment, rescue tools, ladders, ropes and operational safety procedures used during emergency response. • To familiarize the students with rescue operations, casualty handling methods, incident command systems and personal protective equipment used in fire and rescue services. • To make the students learn about specialized rescue systems, modern firefighting technologies and advanced emergency response equipment used in contemporary fire services.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the terminology related to fire appliances, rescue equipment, personal protective equipment and modern firefighting technologies.	Level 1: Remember
CO2	Explain the principles, functions, and operational features of fire appliances, rescue equipment, personal protective equipment and modern firefighting technologies.	Level 2: Understand
CO3	Apply fire appliances, rescue equipment, personal protective equipment and rescue techniques in emergency response operations.	Level 3: Apply
CO4	Analyze the suitability and performance of fire appliances, rescue systems and modern firefighting technologies for different emergency scenarios.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fire Appliances and Firefighting Vehicles: Introduction to fire appliances, Classification of fire appliances, Functional requirements of fire appliances, Fire tender chassis and vehicle design, Water tender, Foam tender, Multipurpose tender, Crash fire tender, Rescue tender, Hose laying tender and control van, Fire pumps and

priming systems, Midship and PTO pump configurations, Hose reels and hose management systems, Water and foam monitors, Vehicle stability and load distribution, Technical specifications of fire appliances, Preventive maintenance and inspection procedures.

Unit-II

Firefighting Equipment and Rescue Tools: Portable fire extinguishers and their applications, Hydraulic rescue equipment, Hydraulic cutters, Spreaders, Rams and combi tools, Pneumatic rescue equipment, Air lifting bags and jacks, Electric power tools, Electric cutters, Electric saws and chain saws, Portable lighting systems and power sources, Ladders and ladder appliances, Extension ladders, Hook ladders, Turntable ladders and snorkels, Ropes and lines used in fire services, Knots, Hitches and their applications, Testing and safety procedures of rescue equipment.

Unit-III

Rescue Operations: Principles of rescue operations, Search and rescue techniques, Rescue planning and operational safety, Casualty handling methods, One rescuer and two rescuer techniques, Multi rescuer techniques, Stretchers and casualty transportation methods, Rescue from fire incidents and high-rise buildings, Rescue during earthquakes, Floods and other disasters, Incident command system (ICS) in rescue operations,

Personal Protective Equipments: Personal protective equipment (PPE), Safety belts and harnesses, Breathing apparatus and associated equipment, Oxygen breathing apparatus, Compressed air breathing apparatus, BA control systems and cylinder management, Gas masks and respirators, Airline and filter type respirators.

Unit-IV

Specialized Rescue Systems and Modern Firefighting Technologies: SCUBA and water rescue equipment, HAZMAT rescue equipment, Emergency rescue tender (ERT), HAZMAT van and decontamination systems, Robotics in firefighting and rescue operations, Drones in fire and rescue services, Thermal imaging systems, Ultra high pressure systems (UHPS), Compressed air foam systems (CAFS), Communication and monitoring systems in emergency response, Smart fire appliances and sensor networks, Artificial intelligence in fire and rescue operations, Recent developments in firefighting and rescue technologies.

Suggested Readings:

- Fire Safety in Buildings by V.K. Jain, New Age International Publishers
- Safety Management by R.K. Mishra, AITBS Publishers
- Manual of Fire Safety by N Sesha Prakash, CBS Publishers and Distributors
- Fire Protection and Prevention: The Essential Handbook Volume 1 & 2 by B.M. Sen, UBS Publishers
- NFPA Manual
- National Building Construction Standard by Bureau of Indian Standards, New Delhi
- Related IS Codes and Standards

<table>
<tr><td>Course Code</td><td colspan="5">ESC-ME-211B</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Heat, Mass Transfer and Thermodynamics</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
● To make the students familiar with the fundamental concepts of thermodynamics and their applications in fire and safety engineering.
● To develop the understanding of students regarding heat transfer mechanisms and their role in fire behavior, thermal insulation and industrial safety applications.
● To familiarize the students with mass transfer, combustion processes, flame characteristics and products of combustion relevant to fire dynamics.
● To make the students learn about explosion phenomena, industrial fire hazards, emergency planning and fire safety practices involving hazardous materials and explosives.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the technical terms of thermal engineering related to fire and safety engineering.	Level 1: Remember
CO2	Explain the fundamental concepts of thermodynamics, heat and mass transfer, and their influence on fire development, flame behavior, combustion, explosion and fire effluents in engineering systems.	Level 2: Understand
CO3	Apply the principles of thermodynamics, heat transfer, combustion, and explosion safety to solve problems in industrial fire safety.	Level 3: Apply
CO4	Analyze fire and explosion hazards, combustion characteristics, thermal behavior of materials, and industrial fire safety measures to evaluate risk control strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Thermodynamics: Basic concepts of thermodynamics, System, Surrounding and boundaries, Types of thermodynamic systems, Thermodynamic properties, State and process, Cyclic process, Reversible and irreversible processes, Work and Heat, Ideal Gas Laws, Equation of state, Specific seat, Zeroth Law of thermodynamics, First Law of thermodynamics, Steady flow energy equation, Enthalpy, Applications of thermodynamics in fire and safety engineering.

Unit-II

Heat Transfer Fundamentals: Introduction to heat transfer, Modes of heat transfer, Thermal conductivity, Heat conduction through plane walls and cylinders, Composite walls, Convection heat transfer, Natural and Forced convection, Radiation heat transfer, Black body and Grey body radiation, Stefan–Boltzmann Law, Heat transfer in fire situations, Thermal insulation and Fire resistant materials, Heat transfer applications in industrial safety.

Unit–III

Mass Transfer and Combustion: Introduction to mass transfer, Diffusion and mass flux, Fick's Law of diffusion, Convective mass transfer, Heat and mass transfer analogy, Fundamentals of combustion, Types of combustion, Combustion of solid, liquid and gaseous fuels, Complete and Incomplete combustion, Stoichiometric combustion, Products of combustion, Smoke and fire effluents, Fire behavior and flame characteristics.

Unit-IV

Explosion and Industrial Fire Safety Applications: Explosion fundamentals, Types of explosions, Fire and explosion hazards in industries, Flammable liquid storage hazards, Major Accident Hazard (MAH) Control, On-Site and Off-Site emergency planning, Petroleum and Explosives Safety Organization (PESO), Fire and explosion prevention measures, Industrial fire safety applications.

Fires Involving Explosives: Introduction, Industrial processes and hazards of explosives, Explosives and fireworks manufacture and filling, Explosive storage, Explosive transport, Causes of fire and methods of protection, Fire extinguishing ball, Jet fire, Pool fire, Boilover, Fire fighting involving explosives in transit, Match manufacture and storage, Material used, Process, Causes of fire and protective measures, Fire fighting.

Suggested Readings:

- Heat and Mass Transfer -3rd edition by PK Nag 2007 Tata McGraw Hill
- Heat and Mass Transfer – revised edition by RK Rajput . S. Chand Publication.
- Heat & Mass transfer 4rd edition by 2014 Yunus A- Cengel Tata McGraw Hill
- Principles of heat transfer by Kreith Thomas Learning 2001
- Fundamental of Heat and Mass Transfer by M. Thirumaleshwar. Pearson.
- Fundamental of Heat and Mass Transfer- 4th edition by C.P.Kothandaraman

Useful Video Links:

Unit No.	Topic	Link	Source
Unit-II	Heat Transfer	https://youtu.be/6Zpf3YpkNCM?si=WhLLog7VWHqqB9q8	NPTEL (IIT Kharagpur)
	Conduction	https://youtu.be/hZBpV_QVJ3Y?si=gkdZn4iSXVXpIvyk	NPTEL (IIT Kharagpur)
	Convection	https://youtu.be/zw884u2pWw0?si=UXn4GVnim-mBMULQ	NPTEL (IIT Kharagpur)

	Radiation	https://youtu.be/TIFGm-QusM4?si=gxeW7TYVqtnnCbHt	NPTEL (IIT Kharagpur)
Unit-III	Combustion	https://youtu.be/Fyq4Q5yWDDU?si=UiglMcNy2y8j5Pvz	NPTEL (IIT Madras)
	Stoichiometric combustion	https://youtu.be/yh1h23fbWtw?si=vxkNdc1J-4UlK5Kt	NPTEL (IIT Madras)
Unit-IV	Explosion	https://youtu.be/19IGLmowQuw?si=EaRFaaiJAikgqlCN	NPTEL (IIT Kharagpur)
	Classification of explosion	https://youtu.be/uwr9a98YJ64?si=xD9qtgX97NJzDtZf	NPTEL (IIT Madras)
	Explosives	https://youtu.be/1_3OOsnjWjo?si=IOwl5pmE7brHZYdr	NPTEL (IIT Kharagpur)
	Nature and properties of explosives	https://youtu.be/i7nE6Pl5uWU?si=cTmdJs1p8Wfc0DvV	NPTEL (IIT Kharagpur)
	Cause of fire and methods of protection	https://youtu.be/PJhjs3gtfEU?si=uBlsCxFZY9eeAlqz	NPTEL (IIT Madras)
	Fire Protection	https://youtu.be/n6HAyxdup_U?si=oxC3ENbX0qMw-Cex https://youtu.be/krnmHKZ87Wg?si=TUKEin4bND_zczdl	NPTEL (IIT Delhi)

Course Code	**LC-PCC-FT-213B**				
Category	Professional Core Courses				
Course Title	**Fire Engineering Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: • To bridge theory and practice by giving students hands-on experience with real-world firefighting equipment, systems, and safety procedures. • To develop practical skills in identifying fire types, selecting appropriate extinguishing agents, and operating fire detection and suppression systems. • To foster critical awareness of fire hazards, structural fire safety, and compliance with national (NBCS) and international (NFPA) fire safety standards. • To prepare students for emergency scenarios by providing training to respond effectively using appropriate firefighting tools and decision-making strategies.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the different types of fires, fire elements, extinguishing agents and their appropriate applications in real-life scenarios.	Level 2: Understand
CO2	Demonstrate the operation and usage of various fire detection, suppression, and firefighting systems including fire extinguishers, hose fittings, sprinkler systems and mobile equipments.	Level 3: Apply
CO3	Analyze the calorific values, flashpoint and fire point of the different fuels.	Level 4: Analyze
CO4	Evaluate structural integrity under fire conditions and interpreting building occupancies and combustion products as per national and international standards.	Level 5: Evaluate

List of Experiments

Sr. No.	Contents
1	To determine the flashpoint and fire point of different fuels using Pensky-Marten apparatus.
2	To study different types of fuels and their calorific values.
3	To study different types of fire and its elements.
4	To study different types of extinguishing media- water, foam, dry powder, ABC Powder, CO2, Halon.
5	To study of Modular Automatic Fire Extinguishers, Trolley Mounted fire extinguishers.
6	To study the different causes and phases of fire.
7	To study the fire detection systems.
8	To study the basic fire protection equipments.

9	To study the Mobile firefighting equipments
10	To study different types of sprinkler systems
11	To study the products of combustion.
12	To study different types of occupancies as per National Building Construction Standards (Latest Edition).
13	To study structural integrity under fire using standard methods of NFPA.
14	To study different types of hose fittings and their application.

At least 10 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**LC-PCC-FT-215B**				
Category	Professional Core Course				
Course Title	**First Aid and Paramedics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: • To familiarize students with first aid kits, emergency equipment and basic medical response procedures. • To develop understanding of major human body systems related to first aid and emergency care. • To train students in CPR, bandaging, slings and safe handling and transportation of victims. • To enable students to understand medical emergencies, accident investigation, reporting and record keeping procedures.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the use of first aid equipment, major human body systems, and basic emergency care procedures.	Level 2: Understand
CO2	Demonstrate cardiopulmonary resuscitation (CPR), bandaging, slings, and victim dressing techniques.	Level 3: Apply
CO3	Perform casualty handling, stretcher operations, and victim transportation techniques in emergency situations.	Level 3: Apply
CO4	Analyze medical conditions, accident investigations, reporting procedures, and record keeping for effective emergency response.	Level 4: Analyze

List of Experiments

Sr. No.	Contents
1	To study the first aid kit.
2	To study different human systems: Respiratory, Circulation, Nervous, Digestive and Excretory systems.
3	To study and perform different techniques of Respiration (CPR).
4	To study various types of Bandages and Slings.
5	To perform the victim's dressing using various types of bandages by first aid responder.
6	To study maintenance of various charts related to casualties.
7	To study of stretchers and its types.
8	To perform and practice the different methods of handling and transportation of victims.
9	To study different types of medical conditions.
10	To study accidents, investigations, reporting and record keeping.

At least 8 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**LC-ESC-FT-217B**				
Category	Engineering Science Courses				
Course Title	**Heat, Mass Transfer and Thermodynamics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop understanding of thermodynamic principles, heat transfer mechanisms, and mass transfer phenomena relevant to industrial and fire safety engineering. • To provide practical knowledge of internal combustion engines, boilers, refrigeration systems, cooling towers, and thermal engineering equipment. • To analyze conduction, convection, radiation, combustion, and diffusion processes through experimental investigations. • To develop the ability to evaluate thermal system performance, energy balance, and industrial fire and explosion hazards using engineering principles and safety practices.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the operating principles of thermodynamic systems, internal combustion engines, boilers, and industrial thermal systems.	Level 2: Understand
CO2	Determine the thermodynamic, heat transfer, and mass transfer characteristics of engineering systems through laboratory experiments.	Level 3: Apply
CO3	Investigate the combustion characteristics and energy performance of thermal systems through experimental studies.	Level 3: Apply
CO4	Analyze industrial fire and explosion hazards to recommend appropriate fire prevention and safety measures.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**
1	To study the basic thermodynamic properties and verify the ideal gas laws.
2	To determine the specific heat capacity of a given substance.
3	To verify the First Law of Thermodynamics using a steady flow process apparatus.
4	To study the working of 2-stroke petrol and diesel engine.
5	To study the working of 4-stroke petrol and diesel engine.
6	To study low and high pressure boilers and their accessories and mountings.
7	To prepare the heat balance sheet for an internal combustion engine.
8	To determine thermal conductivity of insulating and fire resistant materials.

9	To study heat conduction through composite walls and cylinders.
10	To analyze natural and forced convection heat transfer characteristics.
11	To study radiation heat transfer and verify Stefan–Boltzmann law.
12	To determine diffusion coefficient using Fick's law of diffusion experiment.
13	To study combustion characteristics of solid, liquid, and gaseous fuels under complete and incomplete combustion conditions.
14	To study different types of cooling towers and their industrial safety applications.
15	To study industrial fire and explosion hazards including pool fire, jet fire, boilover, and fire prevention measures.

At least 10 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**LC-PCC-FT-219B**				
Category	Professional Core Courses				
Course Title	**Fire Ground Operations -III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objective of this course are ● To provide foundational knowledge of various fire-fighting tools and equipment including hoses, extinguishers, ropes, and ladders. ● To train students in standard operational techniques such as hose drills, rope handling, extinguisher usage, and ladder operations under simulated conditions. ● To develop students' ability to inspect, test, and maintain the performance and safety of fire-fighting equipment as per standard protocols. ● To instill discipline, coordination, and response skills essential for effective participation in real-life fire emergency operations.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the procedures for hose rolling techniques, rope types, and ladder configurations along with their operational relevance in fire safety.	Level 2: Understand
CO2	Work as an individual and in a group with the capacity to be a leader as well as an effective team member.	Level 3: Apply
CO3	Perform standard hose and extinguisher drills, ladder and rope tests, and demonstrate practical handling and maintenance of fire service equipment.	Level 3: Apply
CO4	Analyze the condition and performance of fire-fighting tools and equipment through standard testing methods and drills to ensure operational readiness.	Level 4: Analyze

List of Experiments

1	To study and perform extinguisher drills.
2	To study fire hose (Deliveryhose, Suction hose), Hose binding, Washing, Storage.
3	To study and perform rolling of hoses (Coil roll, Figure of 8 roll, Flaking roll, Dutch roll).
4	To perform different hose tests (Suction hose test, Delivery hose test, Hose reel hose test)
5	To perform the hose drill (Lifting, Lowering, Carrying, Laying, Connect, Disconnect, Remove the kink, Under running)
6	To study the rope construction and types of ropes (Natural rope (a. Italian hemp, b. Manila, c. Sisal, d. Coir, e. Cotton, f. Jute), Manmade rope (a. Synthetic, b. Nylon, c. Steel, d. Cara mandala))

7	To study and perform rolling of ropes.
8	To study and perform testing of ropes.

Other drills and tests can be performed as decided by department (time to time) depending upon the scope of course.

<table>
<tr><td>Course code</td><td colspan="5">MC-201B</td></tr>
<tr><td>Category</td><td colspan="5">Mandatory Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Environmental Science</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-III/IV</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>-</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources.
To develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health.
To foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society.
To engage students in practical learning through field work and case studies to apply environmental concepts for sustainable development and responsible citizenship.</td></tr>
<tr><td>Assessment</td><td colspan="5">20 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">30 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe key terminologies of environmental studies, natural resources, ecosystems, pollution, environmental laws and human-environment interactions.	Level 1: Remember
CO2	Explain the relationships among ecosystems, biodiversity, pollution, social issues, environmental ethics and related legislation for sustainable development.	Level 2: Understand
CO3	Apply principles of environmental management, pollution control, disaster management and sustainable practices in real world environmental contexts.	Level 3: Apply
CO4	Analyze environmental issues, population growth impacts, climate change, welfare programs and the role of information technology in promoting public health and environmental sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts (Covering all units) of 1.5 marks each and remaining eight questions of 6 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance.

Natural Resources: Renewable and Non-Renewable Resources; Natural Resources and Associated Problems.

(a) Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies, Timber Extraction, Mining, Dams and their effects on Forests and Tribal People.

(b) Water Resources: Use and Over-Utilization of Surface and Groundwater, Floods, Drought, Conflicts Over Water, Dams—Benefits and Problems.

(c) Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies.

(d) Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer and Pesticide Problems, Waterlogging, Salinity, Case Studies.

(e) Energy Resources: Growing Energy Needs, Renewable and Non-Renewable Energy Sources, Use of Alternate Energy Sources, Case Studies.

(f) Land Resources: Land as a resource, Land Degradation, Man-Induced Landslides, Soil Erosion and Desertification.

Role of an Individual in Conservation of Natural Resources, Equitable Use of Resources for Sustainable Lifestyles.

Unit-II

Ecosystems: Producers, Consumers and Decomposers, Energy Flow in the Ecosystem, Ecological Succession, Food Chains, Food Webs and Ecological Pyramids—Introduction, Types, Characteristic Features, Structure and Function of Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem and Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans and Estuaries).

Biodiversity and Its Conservation: Introduction, Definition, Genetic Diversity, Species Diversity and Ecosystem Diversity. Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation, Hotspots of Biodiversity.

Values of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values.

Threats to Biodiversity: Habitat Loss, Poaching of Wildlife and Man–Wildlife Conflicts, Endangered and Endemic Species of India.

Conservation of Biodiversity: In-situ and Ex-situ Conservation.

Unit-III

Environmental Pollution: Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution and Nuclear Hazards.

Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies.

Disaster Management: Floods, Earthquakes, Cyclones and Landslides.

Social Issues and the Environment: From Unsustainable to Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rainwater Harvesting, Watershed Management, Resettlement and Rehabilitation of People, Problems and Concerns, Case Studies.

Environmental Ethics: Issues and Possible Solutions, Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies, Wasteland Reclamation, Consumerism and Waste Products.

Environmental Legislation: Environment Protection Act, Air Prevention and Control of Pollution Act, Water Prevention and Control of Pollution Act, Wildlife Protection Act, Forest Conservation Act, Issues Involved in Enforcement of Environmental Legislation, Public Awareness.

Unit-IV

Human Population and the Environment: Population Growth, Variation among Nations, Population Explosion, Family Welfare Programme, Environment and Human Health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies.

Field Work *(Equivalent to 10 Lecture Hours)*

- Visit to a Local Area to Document Environmental Assets—River, Forest, Grassland, Hill or Mountain.
- Visit to a Local Polluted Site—Urban, Rural, Industrial or Agricultural.
- Study of Common Plants, Insects and Birds.
- Study of Simple Ecosystems—Pond, River, Hills, Slopes, etc.

Suggested Readings:

- Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner
- The Biodiversity of India by Bharucha, MAP in Publishing Pvt.Ltd., Ahmedabad.
- Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc.,1989
- Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
- Global Biodiversity Assessment by V.H. Heywood & R.T.Watson, Cambridge University Press, 1995, 1140p.
- Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House, Delhi, 1995, 284p.
- Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
- Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd., 1987, 345p.
- Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut, 2001.
- Survey of the Environment, The Hindu.
- Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
- Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
- Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA, 1998, 499p.
- A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
Unit-II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
Unit-III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

<table>
<tr><td>Course Code</td><td colspan="5">PCC-FT-202B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Structural Fire Engineering</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objective of this course are
• To provide knowledge of building construction, fire safety requirements, and structural fire protection principles.
• To develop understanding of fire-resistant construction, means of escape, fire detection systems, and passive fire protection measures in buildings.
• To familiarize students with fire behaviour, fire load assessment, compartmentation, and fire safety design of building structures.
• To create awareness about national and international standards related to fire safety in buildings and structural fire protection.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the buildings, construction, structural components, and fire safety terminology as per NBCS and IS standards.	Level 1: Remember
CO2	Explain the principles of fire development, building fire behavior, human response, fire detection systems, and compartmentation strategies in fire-safe design.	Level 2: Understand
CO3	Apply national codes and structural safety principles to assess exit planning, stair design, fire-resistant construction techniques, and fire safety systems for safe building designs.	Level 3 : Apply
CO4	Analyze building fire safety, fire severity and structural performance under fire conditions using fire resistance tests, design equations, and material behavior in elevated temperatures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Building Fire Safety: Classification of building based on occupancy as per National Building Construction Standards (NBCS), Classification of types of construction according to fire resistance as per NBCS,General fire safety requirements applicable to all individual occupancies,fire zones as per NBCS, General exit requirements as per NBCS, Means of escape, Internal staircases, Horizontal exits, Fire tower, Ramps, Fire lifts, External fire escape ladders, Planning of location and calculation of capacity, Number and width of exit

as per NBCS for different types of occupancy, Sizes layout and various kinds of stairs in different kind of building, Egress and containment. Fire hazards in stilt parking, Basement parking and podium parking.

Unit-II

Building Materials: Introduction to the elements of structure, Study of different kinds of components of super-structures, Various common types of buildings with reference to relevant I.S. specifications, Different types of walls, Roofs and floors and their construction methods. Behaviour of elements of structure in a fire, Causes of wall collapse, Criteria for assessing the fire properties of building materials and elements of structure, Standards and guides for passive fire protection.

Unit-III

Fire Protection in Buildings: Fire safety in buildings, Process of fire development, Fire behaviour, Human behaviour, Fire detection and control system, Fire resistance, Fire design time, Fire load, and grading of occupancies by Fire load, Controlling fire spread, Compartmentation, Defend in place theory, Fire severity, Equivalent fire severity, Fire resistance test, Fire resistance of assemblies – Walls, Floors, Beams, Columns, Penetrations, joints, Fire doors, Ducts and glasses, Testing and inspection of fire doors, Firestop system, Material and fire dampers, Building construction for fire safety. Fire safety design of façade, Building integrated and building attached photovoltaic system.

Unit-IV

Structural Design: Design of structures exposed to fire - Structural design at normal temperatures, Loads, Structural design in fire conditions, Design equation, Loads for fire design, Structural analysis for fire design, Material properties in fire, Design of individual members exposed to fire, Design of structural assemblies exposed to fire, Structural Steel Fire Protection.

Concrete Structures: Behaviour of concrete structures in fire, Concrete materials in fire, Spalling of cover concrete, Concrete and steel reinforcing temperatures, Mechanical properties of concrete at elevated temperatures, Design of concrete members exposed to fire - Continuous slabs and beams, Axial restraint. International standards for structural fire protection.

Suggested Readings

- Fire Safety in Buildings by V K Jain, New Age publishers, New Delhi.
- National Building Construction Standards (NBCS)- Part-F (Latest Edition) Bureau Of Indian Standards
- Fundamentals of Fire Safety in Building Design by Dr. Than Singh Sharma, Aayush Publications, New Delhi
- Principles of Fire Safety Standards for Building Construction by M. Ya. Roytman, Amerind Publishing Co. Pvt. Ltd., New Delhi
- Structural Design For Fire Safety by Andrew H. Buchanan & Anthony K. Abu, John Wiley and Sons Ltd., New York, U.S.A.
- Relevant IS & NFPA codes
- Building materials and construction by B. C. Punmia, Laxmi Publications.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	General Exit Requirements as per NBC	https://www.youtube.com/watch?v=O6CYQt9vi_Y	NPTEL (IIT Delhi)
	Stairs, Sizes layout	https://www.youtube.com/watch?v=hxakW1miEcM	NPTEL (IIT Kharagpur)
Unit-II	Roofs and floors construction methods	https://www.youtube.com/watch?v=ptsDs8bcxTI	NPTEL (IIT Delhi)
	Building Construction, Components of Super Structure	https://www.youtube.com/watch?v=X9tNq4kRm9s	Unacademy
Unit-III	Fire detection and control system	https://www.youtube.com/watch?v=vNKXzw6GCHw	NPTEL (Madras)
	Building construction for fire safety	https://www.youtube.com/watch?v=Z15UfahUsG0&t=251s	NPTEL (IIT Delhi)
Unit-IV	Fire resistance	https://www.youtube.com/watch?v=SuepcXmNREU	NPTEL (IIT Delhi)
	Structural Steel Fire Protection	https://www.youtube.com/watch?v=uOegFI_jNEc&t=775s	NPTEL (IIT Delhi)

<table>
<tr><td>Course Code</td><td colspan="5">PCC-FT-204B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Fire Protection</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of the principles, components and operation of fire detection, alarm and notification systems used in fire protection engineering.
To develop understanding of water-based, water spray, water mist and foam fire suppression systems and their applications in different occupancies and hazards.
To familiarize students with gaseous, chemical and industrial fire protection systems, explosion protection methods and associated safety considerations.
To enable students to learn inspection, testing, maintenance and design considerations of various fire protection systems in accordance with standard engineering practices and codes.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the principles, components, and terminology of fire detection, alarm, and fire protection systems used in fire and safety engineering.	Level 1: Remember
CO2	Explain the working principles, design concepts, and applications of fire detection, water-based, foam, gaseous, and chemical fire protection systems.	Level 2: Understand
CO3	Apply the principles of fire detection and fire protection systems to select appropriate fire safety measures for buildings and industrial occupancies.	Level 3: Apply
CO4	Analyze the performance of fire protection systems and industrial fire and explosion hazards to recommend suitable fire protection strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

Fire Detection and Alarm Systems: Active and passive fire protection systems, Components of fire detection and alarm systems, heat, smoke, flame and gas detectors, VESDA systems, Notification appliances, Detector selection and spacing concepts, False alarm management, Interconnections and integration, Gas and

vapor detection systems, Electrochemical sensors, Inspection, Testing and maintenance of fire detection and alarm systems.

UNIT – II

Water-Based Fire Protection Systems: Extinguishing mechanism and limitations of water, Automatic sprinkler systems, Principles and types of sprinkler systems, Sprinkler heads and classification, k-factor, Deluge systems, Water supply requirements as per NBC, Fire pumps and pump house arrangements, Terrace tanks and terrace pumps, Overview of fire pump sizing concepts, Standpipe and hose systems, Wet risers, Internal and external hydrants, Zoning in standpipe systems, Hose reels, Inspection, Testing and maintenance of water-based fire protection systems.

UNIT – III

Water Spray, Water Mist and Foam Systems: Water spray systems, Components and applications, Ultra-high-speed water spray systems, Methods of extinguishment, Response time and design considerations, Water mist systems, Methods of generating water mist, Mist classification, Spray characteristics, Applications and limitations, Firefighting foams, Types and properties of foam concentrates, Extinguishing mechanism and limitations of foam, Expansion ratio, Low, Medium and high expansion foam systems, Foam generating equipment, Foam protection systems for storage tanks and industrial hazards, Foam application concepts.

UNIT – IV

Gaseous, Chemical and Industrial Fire Protection Systems: Carbon dioxide fire suppression systems, Extinguishing mechanism and limitations of CO_2, Total flooding and local application systems, Components and safety precautions, Clean agent fire suppression systems, Inert gas and synthetic agents, Extinguishing mechanisms, Design concentration concepts, Pressure relief vents, Applications and limitations, Dry chemical powder, aerosol and wet chemical extinguishing systems, Extinguishing mechanisms, Applications and maintenance, Overview of agent quantity calculations, Industrial fire and explosion hazards, Explosion prevention and protection systems, Deflagration venting and explosion suppression systems, Fire protection considerations in industrial occupancies.

Suggested Readings:

- Industrial Safety, Health & Environment Management System by R.K. Jain & Sunil S. Rao, Khanna Publishers.
- Fire Safety in Buildings by V.K. Jain, New Age International Publishers.
- Fire Protection and Prevention: The Essential Handbook Volume 1 & 2 by B.M. Sen, UBS Publishers.
- Principles of Fire Safety Engineering: Understanding Fire and Fire Protection byAkhil Kumar Das, PHI Learning Private Limited (Prentice Hall India).
- Industrial Safety and Health Management by C. Ray Asfahl and David W. Rieske, Pearson India
- Relevant IS Standards.
- SFPE Handbook of Fire Protection Engineering by Morgan J. Hurley, Society of Fire Protection Engineers (SFPE) / Springer.
- Relevant NFPA Standards.

Course Code	**PCC-FT-206B**				
Category	Professional Core Courses				
Course Title	**Fluid Mechanics and Fire Service Hydraulics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • To introduce students to the fundamentals of fluid mechanics and hydrostatics relevant to fire protection engineering applications. • To develop understanding of fluid flow principles, fire hydraulics and flow measurement techniques used in firefighting systems. • To familiarize students with the operation, performance and maintenance of fire pumps, priming systems and hydrant systems. • To provide knowledge of sprinkler hydraulics, fire water distribution systems and hydraulic design considerations in fire protection engineering.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts of fluid mechanics, fire hydraulics, fire pumps, hydrant systems, and sprinkler hydraulics used in fire protection engineering.	Level 1: Remember
CO2	Explain the behaviour of fluids, flow characteristics, hydraulic principles, pump operations and water distribution systems used in firefighting applications.	Level 2: Understand
CO3	Apply the principles of fluid mechanics and fire hydraulics to analyze fire water supply, pumping, hydrant, and sprinkler systems for fire protection.	Level 3: Apply
CO4	Analyze the hydraulic performance of fire water supply, pumping, hydrant, and sprinkler systems to ensure efficient and reliable fire protection.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit – I

Fundamentals of Fluid Mechanics: Units and systems of measurements, Fluid properties: Density, Specific gravity, Viscosity, Surface tension and capillarity, Newtonian and non-Newtonian fluids, Concept of fluid and flow, Ideal and real fluids, Use of water in fire protection services.

Hydrostatics: Pressure, Pressure head, Pascal's law, Hydrostatic pressure distribution, Pressure variation in compressible and incompressible fluids, Effect of external force on pressure in vessels, Fluid pressure measurement using manometers and Bourdon pressure gauges.

Fire water storage concepts, Estimation of capacity of fire water tanks and reservoirs, Time of filling and emptying tanks, Applications of fluid mechanics in fire protection engineering.

Unit – II

Fluid Flow and Fire Hydraulics: Types of fluid flow, Flow rate and continuity equation, Concept of system and control volume, One-dimensional flow analysis, Euler's equation of motion, Bernoulli's equation and its engineering applications, Measurement of fluid flow using venturimeter, Orifice meter and pitot tube, Flow through pipes, Pressure loss in pipes and hoses, Friction loss calculations, Flow through pipes in series and parallel, Impulse-momentum principle and its applications in fire hydraulics, Design and operation of nozzles, Flow through nozzles, Discharge coefficient, Power transmitted through nozzles, Condition for maximum power transmission, Relation between nozzle and hose diameter, Fire stream characteristics and nozzle reaction.

Unit – III

Fire Pumps and Priming Systems: Classification and operation of fire pumps, Centrifugal pumps, Reciprocating pumps, Multistage pumps, Portable and vehicle-mounted fire pumps, Jockey pumps, Pump characteristics and performance curves, Cavitation and priming principles,Net positive suction head (NPSH), Priming devices and systems, Maintenance and testing of fire pumps, Operational safety and troubleshooting of pump systems.

Unit – IV

Hydrant Systems: Hydrant systems and hydrant accessories, Inspection, testing and maintenance of hydrants, Sources of water supply, Fire water distribution systems, Storage tanks, fire flow requirements, Determination of fire flow with reference to fire load and relevant standards, Principles and operational considerations of water relay systems.

Sprinkler System Hydraulics: Fundamentals of sprinkler hydraulics, Hydraulic analysis of sprinkler systems, Flow and pressure relationships in sprinkler systems, Sprinkler discharge characteristics, Pressure balancing in sprinkler systems, Role of pressure reducing valves, Water supply requirements for automatic sprinkler systems, Safety margins and redundancy in sprinkler system design.

Suggested Readings:

- Hydraulics and Fluid Mechanics by P.N. Modi, Dr. S.M. Seth, Rajsons Publications
- Hydraulic Mechanics and Hydraulics Machines by Dr. J. Lal, Metropolitan Book Pvt. Ltd.
- Manual of Firemanship
- Fire Service Hydraulics by Dr. G.C. Mishra, Masood Books
- Fluid Mechanics and Hydraulic Machines by Dr. R. K. Bansal, Laxmi Publications
- Fire Service Hydraulics and Pump Operations by Paul Spurgeon
- Sprinkler Hydraulics by Wass Jr.
- Fire Pumps and Hydraulics by I.E. Ditts and T.M. Harris.
- Fire-Fighting Hydraulics byPurington

<table>
<tr><td>Course Code</td><td colspan="5">PCC-FT-208B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Industrial Hygiene and Occupational Health</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester -IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To introduce students to chemical, physical and occupational hazards associated with industrial work environments.
• To develop understanding of industrial ventilation, exposure assessment and occupational hygiene practices for hazard control.
• To familiarize students with occupational diseases, medical surveillance systems and workplace health protection measures.
• To provide knowledge of personal protective equipment, respiratory protection systems and regulatory requirements for occupational safety management.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the concepts related to industrial hygiene, hazards, occupational health and personal protective equipment used in occupational safety engineering.	Level 1: Remember
CO2	Explain the principles of exposure assessment, toxicology of industrial chemicals, ventilation systems, hazards, occupational diseases and PPE systems in industrial environments.	Level 2: Understand
CO3	Apply industrial hygiene principles, exposure control methods, ventilation techniques, ergonomic practices, and PPE selection procedures for managing workplace hazards and occupational risks.	Level 3: Apply
CO4	Analyze different hazards along with occupational health risks, exposure patterns, and control measures for improving workplace safety and health conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Chemical Hazards: Introduction to industrial hygiene, Types of chemical hazards in industry: Dust, Gases, Fumes, Mists, Vapours and smoke. Toxicological properties of chemicals and routes of exposure, Exposure assessment and air sampling techniques, Personal and area monitoring, Threshold limit values (TLV), Permissible exposure limits (PEL) and occupational exposure standards, Effects of key industrial chemicals

such as chlorine, Ammonia, and other toxic gases. Storage, Handling and transportation of hazardous chemicals, Chemical safety in process industries.
Industrial Ventilation: Principles of natural and mechanical ventilation, General and local exhaust ventilation systems, Design considerations and control of airborne contaminants.

Unit-II

Physical Hazards: Illumination and lighting standards, Thermal radiation, Ultraviolet and ionizing/non-ionizing radiation, Preventive and control measures.
Noise: Measurement techniques, Noise surveys, Noise dose, Hearing loss mechanisms and noise control methods.
Vibration: Types, Effects on human body, Hand-arm and whole-body vibration, Isolation techniques.
Thermal Stress: Heat balance, Heat stress indices, Heat disorders, Prevention and control measures.
Work physiology: Classification of workload, Human energy expenditure, Work capacity, Job–man alignment, Fatigue and recovery.
Ergonomics: Principles, Human-machine interaction, Posture analysis and methods of reducing musculoskeletal and postural strain in industry.

Unit-III

Occupational Health and Diseases: Concept of occupational health and industrial medical services, Occupational diseases- Silicosis, Asbestosis, Pneumoconiosis, Lead, Nickel, Chromium, Manganese toxicity and their effects, Occupational cancer, Occupational dermatitis and other work-related diseases: Causes, Exposure pathways and prevention strategies, Medical surveillance of workers, Occupational health centre, Health records and reporting systems, Prevention and control of occupational diseases, Occupational hygiene practices and health risk reduction strategies, Occupational disease compensation systems and legal provisions, Fundamentals of first aid and emergency medical response in industries.

Unit-IV

Non Respiratory Personal Protective Equipments: Head protection, Hearing protection, Face and eye protection, Feet protection, Body protection, Selection, Use, Inspection, Care and maintenance of personal protective equipment.
Respiratory Personal Protective Equipments: Classification of respiratory hazards, Types of respirators and breathing apparatus, Selection criteria, Usage procedures and training requirements, Selection of respirators, Care & maintenance of breathing apparatus.
Workplace safety laws and regulatory requirements related to PPE usage, Industrial safety management practices for PPE compliance and occupational risk reduction.

Suggested Readings

- Industrial Safety and Health Management by R.K. Jain, Sunil S. Rao, Khanna Publications.
- Safety Management, 1st Edition by R.K. Mishra, AITBS Publisher India.
- Fundamental of industrial safety and health by KU mistry, Shyamaraj Global Commerce.
- Industrial Safety Management by Pravin M. Pathak, Jayant P. Khairnar, Notion Press.
- Principles of Industrial Safety Management: Understanding the Ws of Safety at Work by Akhil Kumar Das, PHI Learning
- Industrial Safety Managementby NaseerElahi, Kalpaz Publications.
- Safety Management System and Documentation Training Programme Handbook (Pb 2019) by SV Paul, CBS Publication.
- Safety, Occupational Health and Environmental Management in Constructionby S.C.Sharma, Vinit Kumar, Khanna Publishers.
- Industrial Safety and Maintenance Managementby M.P. Poonia, S.C. Sharma, P. Sojan Lal, Khanna Publishing House, New Delhi

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Introduction of Industrial Hygiene	https://youtu.be/lJnLdUFx2gc	NPTEL (IIT Roorkee)
	Toxicological properties and routes of exposure	https://youtu.be/jZvgAUYtS_Y	NPTEL (IIT Roorkee)
	Dose response relationship	https://youtu.be/IxRvsiZkZQ0	NPTEL (IIT Roorkee))
Unit-II	Noise vibration and radiation	https://youtu.be/IxRvsiZkZQ0	NPTEL (IIT Roorkee)
	Heat and stress	https://youtu.be/eIBHwaoG7rM	NPTEL (IIT Guwhati)
Unit-III	Radiation Effects	https://youtu.be/ttfmgTweI-4	NPTEL (IIT Madras)
Unit-IV	Safety Law	https://youtu.be/jFDWlKayrTc?list=PLbRMhDVUMngdXebaRB59KdKwstzuAovua	NPTEL (IIT Kharagpur)

<table>
<tr><td>Course Code</td><td colspan="5">PCC-FT-210B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Electrical Fire Safety Practice and Standards</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To introduce students to electrical materials, wiring systems, protection devices and electrical safety practices used in industrial and fire safety applications.
• To develop understanding of electrical fire hazards, insulation failures, electrical shock phenomena and fire investigation procedures.
• To familiarize students with hazardous area classification, explosion proof equipment and statutory safety requirements related to electrical systems.
• To provide knowledge of electrical fire prevention, safety management practices and investigation techniques for electrical failures and fires.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the terminology related to electrical systems, protection devices, electrical fires, hazardous zones and fire safety.	Level 1: Remember
CO2	Explain the principles of electrical systems, protection devices, electrical fire mechanisms, shock phenomena, hazardous area classification, and statutory requirements.	Level 2: Understand
CO3	Apply electrical safety principles, protection systems, firefighting procedures, and statutory guidelines to minimize electrical fire and shock hazards.	Level 3: Apply
CO4	Analyze electrical failures, fire incidents, hazardous installations, and management practices to recommend appropriate preventive and control measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Conductor, Classification and property of conductors, Semiconductors, Cables, Wires, Wire splicing and termination, Joints, General electrical accessories and insulating materials.

Terminology: Electrical fire, Failure, Defect, Seed defect, Modes and mechanism of failure, Failure rate, Metal fatigue, Elasticity of metals, Creep, Stress, Strain, Elastic and endurance limit.
Wiring System: System of supply, Selection of wiring, Rules and system of wiring, Separation of power and lighting circuit, Necessity of earthing, System of earthing, Rules of earthingand Methods of improving the earth resistance.

Unit-II

Protection Devices: Introduction, Features of good protective device, Relays, Fuses, Circuit breaker, General specification of MCB's, Trip mechanism, ELCB, RCCB.

Electrical Fire: Introduction, Causes of electrical fires, Failure of insulation, Types and causes, Transformer failure, Failure modes, Investigation overheating/ burning of crimped sockets, Failure of plug and socket connectors.

Unit-III

Electrical Shock Phenomenon: Shocks from AC and DC system, Medical analysis of electrical shock, Prevention of shocks, Safety precaution in electrical plant, Safety precaution against contacts shock, Flash shocks and burns.

Electricity and the Fire Service: Introduction, Electrical hazards and safeguards, Firefighting procedure, Fires in generating stations, Fires in transformers, Fires in substations, Fires in cable boxes, Fires in industrial premises, Fires in private dwellings, Fires involving storage batteries, Fires involving electric railways, Fires in motor cars, relevant standards.

Unit-IV

Hazardous Zones: Classification of hazardous zones, intrinsically safe and explosion proof electrical apparatus, Selection of equipment in hazardous area Electrical Fires, Hazards of static electricity, Safety procedures in electrical maintenance, statutory requirements from electrical inspectorate, Introduction to Indian Electricity Act and Rules.

Investigation of failures and fires: Process of investigation, failure investigation: step by step approach, investigation of electrical fire, action plan.

Role of the Management: Materials and Training, preparation of specification, selection of supplier, inspection of material, training of staff, tools and instruments.

Suggested Readings:

- Electrical Wiring Estimating and Costing by S.L. Uppal, Khanna Publishers.
- Electrical Fires and Failures by A.A. Hattangadi, TMH Publishers.
- Electricity Fire Risk by G.S. Hoges.
- NFPA Manual.
- J.P. Handbook.
- Electrical Safety, Fire Safety and Safety Management by S. Rao, Khanna Publishers, Delhi
- Electrical Safety Handbook by John Cadick, TMH publishers, 6th Edition
- Basic Electrical Engineering by C.L.Wadhwa, New Age Publishers

<table>
<tr><td>Course Code</td><td colspan="5">LC-PCC-FT-212B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Structural Fire Engineering Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide hands-on practical knowledge of the mechanical and structural properties of construction materials such as steel, concrete, timber and burnt clay bricks under normal and fire-exposed conditions.
To build competency in analyzing material behavior under loading, bending, and elevated temperature conditions for safe structural design and fire safety applications.
To familiarize students with destructive and non-destructive testing techniques for evaluating the performance, durability and integrity of structural materials.
To enhance understanding of fire resistance and fire performance testing of structural components, fire doors and fire stop materials in accordance with relevant national and international standards.</td></tr>
<tr><td>Assessment</td><td colspan="5">10 Marks</td></tr>
<tr><td>End Semester Practical Examination</td><td colspan="5">15 Marks</td></tr>
<tr><td>Total</td><td colspan="5">25 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the properties of steel, concrete, timber, and burnt clay bricks using standard laboratory tests.	Level 2: Understand
CO2	Demonstrate testing procedures for tensile strength, compressive strength, strain, moisture content, water absorption, and Young's Modulus.	Level 3: Apply
CO3	Analyze the behavior of structural materials using destructive and non-destructive testing methods.	Level 4: Analyze
CO4	Evaluate the fire resistance and fire performance of structural components and firestop systems as per relevant standards.	Level 5: Evaluate

List of Experiments

Sr. No.	Contents
1	To determine the tensile strength of steel at ambient temperature.
2	To measure the strain in steel using strain gauge.
3	To determine the compressive strength of concrete at ambient temperature.

4	To determine the compressive strength of concrete by Non-Destructive Testing.
5	To determine the moisture content of timber using oven drying methods.
6	To study the fire resistance testing of structural components including fire doors, beams, columns, slabs, and facade systems according to relevant standards.
7	To determine the Young's Modulus of a bar material under non-uniform bending by measuring its deflection.
8	To evaluate the fire performance of firestop and sealing materials according to relevant standards.
9	To determine the water absorption of burnt clay brick.
10	To determine the compressive strength of burnt clay brick.

At least 8 experiments to be performed from the above list and other experiment can be performed depending upon the scope of course as decided by department.

Course Code	**LC-PCC-FT-214B**				
Category	Professional Core Courses				
Course Title	**Fire Protection Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To provide practical knowledge of fire detection, alarm and fire protection systems used in fire safety engineering. • To develop understanding of the operation, inspection, testing and maintenance procedures of fire protection systems and equipment. • To familiarize students with extinguishing agents, foam systems and firefighting equipment used in fire suppression applications. • To provide hands-on exposure to testing procedures, operational demonstrations and maintenance practices as per relevant fire safety standards and codes.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain about the components, operation, applications and limitations of fire detection, alarm and fire protection systems used in firefighting.	Level 2: Understand
CO2	Perform operational testing, inspection and maintenance procedures for fire protection systems and portable fire extinguishers as per relevant standards.	Level 3: Apply
CO3	Determine the physical properties, expansion ratio and drainage characteristics of firefighting foam concentrates and foam systems.	Level 4: Analyze
CO4	Assess the performance, applications and maintenance requirements of firefighting agents, foam systems and fire protection equipment.	Level 5: Evaluate

List of Experiments:

Sr. No.	**Contents**
1	To study the components, principle of operation, testing and maintenance of Fire Detection and Alarm Systems.
2	To study the layout, components and basic requirements of Fire Pump House as per relevant standards.
3	To study the components, principle of operation, inspection, testing and maintenance of Fire Hydrant Systems.
4	To study the components, principle of operation and applications of Automatic Sprinkler Systems.
5	To perform operational testing and discharge demonstration of portable fire extinguishers including water, foam and dry chemical powder type extinguishers as per relevant IS standards.
6	To study Passive Fire Protection Systems including fire doors, fire stopping systems and

	compartmentation.
7	To study the extinguishing mechanism, applications and limitations of water as a firefighting agent.
8	To study the extinguishing mechanism, applications and limitations of Dry Chemical Powder extinguishing agents.
9	To determine the physical properties of foam concentrates used for mechanical foam firefighting systems as per relevant IS standards.
10	To determine the expansion ratio and drainage characteristics of mechanical firefighting foam.
11	To study the operation and applications of foam generating equipment and foam protection systems.
12	To conduct inspection, testing and maintenance procedures for fire protection systems as per relevant codes and standards.

Note:At least 10 experiments to be performed from the above list and other experiment can be performed depending upon the scope of course as decided by the department.

Text Books/ Reference Books:

- Industrial Fire Protection Engineering by Robert G. Zalosh.
- NFPA Fire Protection Handbook - National Fire Protection Association.
- SFPE Handbook of Fire Protection Engineering - Society of Fire Protection Engineers.
- Fire Protection Systems by A. Maurice Jones Jr.
- Principles of Fire Protection by Arthur E. Cote and Percy Bugbee.
- National Building Construction Standard Part-F: Fire and Life Safety.
- Relevant Indian Standards related to Fire Detection and Alarm Systems, Hydrant Systems, Sprinkler Systems, Fire Pumps, Fire Extinguishers and Foam Systems.
- Relevant NFPA Standards including NFPA 10, NFPA 11, NFPA 13, NFPA 14, NFPA 20, NFPA 24, NFPA 72 and NFPA 101.
- UL Standards related to Fire Protection Systems and Equipment.
- Manufacturer manuals and technical data sheets related to Fire Detection Systems, Sprinkler Systems, Fire Pumps, Hydrant Systems and Foam Systems.

Course Code	**LC-PCC-FT-216B**				
Category	Professional Core Courses				
Course Title	**Fire Service Hydraulics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To introduce students to fundamental principles and tools used in hydraulic and fire safety systems. • To develop students ability to conduct experiments and analyze hydraulic performance in fire protection applications. • To familiarize students with essential fire protection components such as hydrants, pumps, and sprinkler systems. • To instill practical skills for evaluating and maintaining fluid dynamics equipment used in fire engineering.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the principles of water supply systems, hydrant types, and the physical properties of water used in fire protection.	Level 2: Understand
CO2	Apply the continuity equation and flow measurement techniques to measure discharge through pipes, nozzles, and firefighting hoses.	Level 3: Apply
CO3	Analyze the impact of free water jets on different surfaces and evaluate flow characteristics through different firefighting equipment.	Level 4: Analyze
CO4	Evaluate the performance, efficiency, and operational reliability of pumps and automatic sprinkler systems used in fire suppression.	Level 5: Evaluate

List of Experiments

Sr. No.	**Contents**
1	To study pressure measurement devices.
2	To study and identify different types of fire hydrants and their components.
3	To measure force exerted by jet on stationary and moving plates (Impact of jet apparatus).
4	To determine discharge through rectangular and trapezoidal notches.
5	To verify Bernoulli's theorem for flow through pipes.
6	To determine pressure loss in pipes due to friction (Darcy-Weisbach Equation)
7	To determine coefficient of discharge for venturimeter.
8	To determine efficiency of centrifugal pump and plot operational characteristics curve.
9	To determine efficiency of reciprocating pump.
10	To test the activation and spray pattern of a sprinkler head.

Note: At least 8 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Course Code	**LC-PCC-FT-218B**				
Category	Professional Core Courses				
Course Title	**Industrial Hygiene and Occupational Health Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To provide practical exposure to measurement and monitoring techniques used for assessment of occupational health hazards in workplaces. • To develop understanding of industrial hygiene instruments and methods used for evaluation of physical, chemical and ergonomic hazards. • To familiarize students with occupational health assessment procedures, air monitoring techniques and workplace safety evaluation practices. • To provide hands-on knowledge of personal protective equipment evaluation, workplace ventilation assessment and industrial exposure monitoring techniques.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Conduct air sampling, dust monitoring, gas detection and ergonomic assessment for identification of occupational health hazards in industries.	Level 3: Apply
CO2	Assess personal protective equipment practices, workplace exposure conditions and control measures for improvement of occupational health and safety.	Level 4: Analyze
CO3	Evaluate noise exposure, lung function, hearing capability, occupational fitness and workplace ventilation conditions using standard assessment techniques.	Level 5: Evaluate
CO4	Measure workplace noise, illumination, heat stress, airborne contaminants and gas concentrations using industrial hygiene instruments and monitoring devices.	Level 5: Evaluate

List of Experiments:

S.No.	**Contents**
1	To measure workplace noise levels using an Integrated Sound Level Meter.
2	To evaluate noise exposure dose using a personal noise dosimeter.
3	To measure illumination levels at workplace using a Lux Meter.
4	To assess thermal comfort and heat stress using WBGT apparatus.

5	To perform lung function testing using a Spirometer.
6	To evaluate hearing capability and hearing loss using a Pure Tone Audiometer.
7	To conduct vision testing for occupational fitness assessment.
8	To conduct air sampling and dust monitoring using a personal air sampling pump.
9	To determine airborne dust concentration using a High Volume Air Sampler.
10	To monitor the presence of toxic gases using portable gas detection instruments.
11	To detect the presence of flammable gases using a combustible gas indicator.
12	To assess ergonomic risk factors associated with body posture and manual material handling activities.
13	To select, use and maintain Personal Protective Equipment used in industries.
14	To assess workplace ventilation effectiveness using airflow measurement devices.
15	To monitor ammonia concentration and evaluate control measures in industrial environments.

Note: At least 10 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**LC-PCC-FT-220B**				
Category	Professional Core Courses				
Course Title	**Fire Ground Operations -IV**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To familiarize students with essential fire-fighting equipment including hoses, extinguishers, ropes, and ladders used in field operations. • To train students in correct handling techniques and drills for fire hoses, extinguishers, and ladders following safety protocols. • To develop practical competence in inspecting, testing, and maintaining the functional readiness of fire-fighting equipment. • To promote teamwork, coordination, and responsiveness essential for real-time fire emergency handling through structured drills and exercises.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain the operational principles, testing standards, and storage techniques for fire-fighting hoses, hydrant, extinguishers, ladders and ropes.	Level 2: Understand
CO2	Perform hydrant drills, hydrant testing, and fire extinguisher operations for emergency response.	Level 3: Apply
CO3	Demonstrate pump drills and ladder testing procedures using standard firefighting practices.	Level 3: Apply
CO4	Analyze the readiness, safety, and effectiveness of fire-fighting equipment through inspection and standard testing methods.	Level 4: Analyze

List of Experiments

Sr. No.	Contents
1	To study different types of hydrants: Ball type, Sluice valve, Screw down, Pillar and post types of valves.
2	To study different types of hydrant fittings, Types of hydrant gear, Hydrant testing equipment.
3	To perform three men hydrant drill (Add, Remove and replace of hose, Dividing breeching, Collecting breeching.
4	To perform four men hydrant drill (Add, Remove and replace of hose, Dividing breeching, Collecting breeching).
5	To perform hydrant test.
6	To study different types of fire extinguishers, Rating of portable extinguishes for class A, B and C fires. Limitations of portable extinguishers, Operation, Refilling, Testing and maintenance of fire

	extinguishers, Inspection requirement of portable extinguishers.
7	To perform a foam drill.
8	To perform four men pump drill.
9	To perform a six men pump drill.
10	To study different types of ladders and their parts.
11	To perform different ladder tests (Round test, String test, Extension line test).

Other drills and tests can be performed as decided by department (time to time) depending upon the scope of course.

<table>
<tr><td>Course Code</td><td colspan="5">PEC-FT-222B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Industrial Psychology</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To introduce students to the fundamentals, development and applications of industrial psychology in workplace environments.
To develop understanding of individual behaviour, motivation, job satisfaction and psychological factors influencing work performance.
To familiarize students with employee selection methods, job analysis techniques and fair employment practices used in organizations.
To provide knowledge of performance appraisal, organizational training and career development practices in industrial management.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the concepts, theories, psychological factors and workplace practices associated with industrial psychology and employee behaviour.	Level 1: Remember
CO2	Explain the principles of motivation, job satisfaction, employee selection, job analysis, performance appraisal and organizational training used in workplaces.	Level 2: Understand
CO3	Apply psychological principles and assessment techniques for employee management, performance evaluation and workplace development.	Level 3: Apply
CO4	Analyze individual behaviour, motivational factors, appraisal systems and training practices for improving organizational effectiveness and employee performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Industrial Psychology: Nature and Development of Industrial/Work Psychology - Historical background, Scientific Management, Time and Motion Study, Hawthorne Studies, World War I & II, Scope &Challenges, Current status.

Unit-II

People at Work: Individual Differences, Personality, Intelligence, Emotional Intelligence, Creativity & Innovation, Perception & Attitudes. Motivation, Expectancy, Equity & Goal Setting Theories,

ModernApproach to Motivation: Employee Predisposition, Expectations, Goals, & Incentives Job Satisfaction- Job Characteristic Theory (Diagnostic Model), Measuring Job Satisfaction Psychometric Testing at Work- Cognitive Abilities.

Unit-III

Managing People at Work-I: Employee Selection- Techniques, Fair Employment Practices, Recruitment, Biographical Information, Interviews, References& Letters of Recommendation. Job Analysis, Types, Newer Developments.

Unit-IV

Managing People at Work-II Performance Assessment: Evaluation & Appraisal- Objective & Subjective Techniques, Bias in Appraisals, Development Plans, Organizational Training,Types of Training, Psychological Issues, Career Development & Planning.

Suggested Readings:

- Introduction to Industrial and Organizational Psychology by Duane P. Schultz & Sydney, Ellen Schultz Pearson Education, New Delhi.
- Industrial Psychology by Michael G. Aamodt, Cengage Learning, Delhi.
- Work Psychology by L. Matthewman, Anabel Rose & Amanda Hetherington, Oxford University Press, New Delhi.
- Work in the 21st Century: An Introduction to Industrial and Organizational Psychology by Frank J. Landy& Jeffrey M. Conte, Wiley India, New Delhi.
- Industrial Psychologyby Ashish Pandey & Atul Kumar Sharma, Global Academic Publishers, New Delhi.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	History and Genesis of Psychology	https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_hs14	NPTEL(IIT Kharagpur)
	Scientific management and time motion study	https://onlinecourses-archive.nptel.ac.in/noc18_me68/preview?utm_source	NPTEL(IIT Roorkee)
Unit-II	Organizational Behaviour (Personality, Attitude and Perception)	https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_mg73	NPTEL(IIT Hyderabad)
Unit-III	Recruitment and Selection	https://www.digimat.in/nptel/courses/video/122105020/122105020.html?utm_source	NPTEL IIT(Kharagpr)
Unit-IV	Performance Evaluation and Career development and Planning	https://www.classcentral.com/course/youtube-core-human-resource-management-i-47643?utm_source	NPTEL(IIT kharagpur)

Course Code	**PEC-FT-224B**				
Category	Professional Elective Courses				
Course Title	**Chemical Process Safety**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To develop the understanding of students regarding foundational understanding of process safety culture, risk perception, and regulatory frameworks in industrial operations. • To make the students familiar with knowledge of toxicology, industrial hygiene, and hazard identification related to chemical exposure. • To train students in preventive strategies for fire, explosion, and chemical reactivity hazards in process industries. • To introduce safety design strategies, relief systems, and real-world case-based learning for effective hazard mitigation.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the terms related to process safety, toxicology, industrial hygiene, fire and explosion, reliefs, safety strategies and hazard mitigation frameworks.	Level 1: Remember
CO2	Explain the fundamentals of risk analysis, fire/explosion prevention, toxicant exposure control, chemical reactivity and process safety strategies.	Level 2: Understand
CO3	Apply process safety principles, industrial hygiene practices, fire and explosion prevention methods, and relief system concepts to industrial processes.	Level 3: Apply
CO4	Analyze process hazards, toxic exposures, fire and explosion risks and safety strategies to recommend appropriate risk control measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Definition, myths about process safety, Safety culture, Essential features of safety culture, Individual risk, Societal risk and risk populations, Voluntary and involuntary risk, Safety metrics, Safety and accident loss statistics, Risk perception, Risk tolerance/acceptance and risk matrix, Risk management and hazardous substance rules, The CCPS 20 elements of risk-based process safety, Inherently safer design, strategies.

Unit-II

Toxicology: Introduction, Routes & exposure, Entry routes for toxicants and methods for control, Elimination of toxicants from the body, Effects of toxicants on the body, Dose response relationship, Dose response and threshold dose: predictive models and extrapolation, Relative toxicity.

Industrial Hygiene: Regulations and identification, Anticipating and identifying hazardous workplace exposures, Globally harmonized system for safety data sheets, Globally harmonized system for labeling, evaluate the magnitude of exposures and responses, noise, Vibration and radiation, develop and evaluate control techniques to prevent exposures, National Fire Protection Association Diamond.

Unit-III

Concepts to Prevent Fires and Explosions: Inerting and purging, Static electricity, General design methods to prevent fire, Explosion-proof equipment and instruments, Ventilation, Fire extinguishers, Sprinkler systems, Industry's fire and explosion protection strategy.

Chemical Reactivity: Key steps in reactivity hazard evaluation, Commitment, Awareness and identification of reactive chemical hazards, controlling reactive hazards.

Unit-IV

Introduction to Reliefs: Relief concepts, Definitions, Type of reliefs and characteristics, Code requirements, Relief system design, Relief installation practices, Relief effluent handling.

Safety Strategies, Procedures and Designs: Process safety strategies, Safe operating procedures, Safe work practices, Designs for process safety, Designs for runaway reactions, Designs and practices for the safe handling of dusts, Case histories and lessons learned.

Suggested Readings:

- Chemical Process Safety: Fundamentals with applications by Crowl and Louvar (2002), New Jersey: Prentice Hall.
- Evaluating Process Safety in the Chemical Industry by Arendt and Lorenzo (2000), New York: CCPS.
- Lees Handbook of Loss Prevention in Chemical Process Industries: hazard identification, assessment and control by Lees F. P. (2005), Butterworths.
- King's safety in the process industries by King et al. (1998), London: Wuerz Publishing Ltd.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Safety and Accident Loss Statistics	https://www.youtube.com/watch?v=dlhXg7KkD0M	NPTEL (IIT Roorkee)
	Risk Management and Hazardous Substance Rules	https://www.youtube.com/watch?v=QYBA9FNoNDw	
Unit-II	Introduction, Routes & Exposure	https://www.youtube.com/watch?v=jZvgAUYtS_Y	
	Dose Response Relationship	https://www.youtube.com/watch?v=jZvgAUYtS_Y	
	Dose Response and Threshold Dose: Predictive models and Extrapolation	https://www.youtube.com/watch?v=_Ut_1L2JlQA	
Unit-III	Designs to prevent Fire and Explosion: Inerting and Purging	https://www.youtube.com/watch?v=PaBDQ-lOGRM	
	Sprinkler Systems	https://www.youtube.com/watch?v=ZKsqIPM810M	
Unit-IV	Introduction to Reliefs	https://www.youtube.com/watch?v=Cs8DQ_9f5qM	
	Type of Reliefs	https://www.youtube.com/watch?v=Q-4601m2zag	

Course Code	**PEC-FT-226B**				
Category	Professional Elective Courses				
Course Title	**Environmental Engineering and Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objective of this course are • To develop understanding of air, water, solid, and hazardous waste pollution and control methods. • To familiarize students with environmental monitoring, treatment techniques, and waste management practices. • To develop awareness about environmental management systems, cleaner technologies, and sustainable industrial practices. • To enable students to understand environmental legislation, ISO 14001 EMS, and pollution prevention strategies.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the terminology related to pollution control, waste management, and environmental management.	Level 1: Remember
CO2	Explain the principles of pollution control, waste treatment, and environmental management systems.	Level 2: Understand
CO3	Apply pollution control and waste management techniques for environmental protection.	Level 3 : Apply
CO4	Analyze environmental pollution and management practices to recommend sustainable solutions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 partsof 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Air Pollution: Sources of air pollution, Effects of air pollution, Classification of pollutants, Atmospheric transport of pollutants-Wind profiles, Atmosphere stability, Inversion, Turbulence, Dispersion and diffusion of air pollutants, Gaussian plume dispersion model, Principles and techniques of ambient air and stack emission monitoring, Particulate matter control equipments, Working principles of gravity settlers , cyclones, wet scrubbers, fabric filters and electrostatic precipitators, Gaseous control methods- an overview of absorption, Adsorption and combustion methods; Biological methods for VOC and odor control.

Unit-II

Waste Water: Physical, chemical and biological characteristic of waste water, Effects of pollutants on water quality and aquatic life, Physical unit operations in waste water treatment-Flow equalization, Sedimentation and flotation, Chemical unit processes in waste water treatment-Coagulation and flocculation, Chemical precipitation and adsorption, Biological unit processes: kinetics of microbial growth.
Aerobic Treatment Systems: Working principle and design parameters of trickling filter, Activated sludge process and rotating biological contactor.
Anaerobic Treatment Systems: Mechanism of anaerobic process, Low rate and high rate digesters, Working principle and applications of anaerobic filters and UASB, Biological nitrification: Denitrification, Characteristics and treatment methods forthe waste water from fertilizer plants, petroleum refineries, Pulp and paper mills and distilleries.

Unit-III

Solid Wastes: Environmental, Aesthetic and health risk, Sources, Quantities and composition of solid wastes, Storage, collection and transportation of urban solid waste, Disposal options- Sanitary landfills, Composting and its variations, Anaerobic digestion, Incineration and pyrolysis, Vermicomposting, Recovery alternative, Monitoring of solid wastes.

Hazardous Wastes: Definition and classification, Health and environmental effects, Treatment, Disposal and management of hazardous wastes, Legal frame work for hazardous waste management in India.

Unit-IV

Environmental Management in Industries: Principles and requirements of ISO 14001 EMS, Environmental auditing and auditing for waste minimization, Environmental impact assessment, Prediction and assessment of impacts, Methods of impact analysis, Indian scenario, Public participation in environmental decision making, Strategies for pollution prevention- Recycle and reuse, Cleaner technologies.

Life cycle Assessment: Principle and methodology, Industrial ecology, Clean development mechanism (CDM), Carbon trading.

Suggested Readings

- Environmental Pollution Control Engineering by C.S. Rao, New Age International (P) Ltd.
- Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, Publishing Co. Pvt. Ltd, New Delhi.
- Handbook of solid waste Disposal and Management by Pavani, J. L, New Age International (P) Ltd.
- Waste Water Engineering: Treatment, Disposal, Reuse by Metcalf and Eddy Inc, Tata McGraw-Hill Publishing Company Limited, New Delhi.
- Environmental Impact Assessment by Canter. L.W, Irwin / McGraw – Hill,NewYork.
- Environmental Engineers Handbook by David, H.F. Liu, Lewis Publishers, New York.
- Industrial Safety, Health and Environment Management System by R.K. Jain and S.S. Rao, Khanna Publishers.
- Safety in Chemical Plants/ Industry & its Management by B. K. B.Rao, R .K. Jain, V. Kumar, Khanna Publishers.
- Environmental Health and safety: Principles and Practices by S. Alauddin, C. Bhattacharya, S. Rawat, A. K. Saran, RK Publication.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Introduction of air pollution	https://youtu.be/u142u-wJFwI?list=PLLy_2iUCG87BwOQUbS7WSdMVWHDXByk-w	NPTE (IIT Roorkee)
	Impact of air pollution	https://youtu.be/z4YFkK3Wtsg?list=PLLy_2iUCG87BwOQUbS7WSdMVWHDXByk-w	NPTE (IIT Roorkee)
	Atmospheric stability and lapse rate	https://youtu.be/rQjTM7AVK2k?list=PLLy_2iUCG87BwOQUbS7WSdMVWHDXByk-w	NPTE (IIT Roorkee)
Unit-II	Water and waste water characteristics	https://youtu.be/wI7uvQThX8A	NPTEL (IIT Madras)
	Coagulation and flocculation	https://youtu.be/p2ZtijyhLQE?list=PLLy_2iUCG87A3YUD6wAYrgnhCsYhk72Tw	NPTE (IIT Roorkee)
	USAB Reactor	https://youtu.be/tNq7lZLqCiU	NPTE (IIT Kharagpur)
Unit-III	MSW management	https://youtu.be/cjIacnNRLHE?list=PLwdnzlV3ogoXAap_BHeApkcF7M8nt13hv	NPTE (IIT Guwahati)
	Landfilling	https://youtu.be/19JtBKeENAQ	NPTE (IIT Guwahati)
Unit-IV	EMS	https://youtu.be/BYqLRGawoH0	NPTE (IIT Guwahati)
	EIA	https://youtu.be/_iLdyhgFv1U?list=PLA44FuTLCwbfl50Onai5LZRDw9mAIlzfS	NPTE (IIT Guwahati)

<table>
<tr><td>Course Code</td><td colspan="5">PEC-FT-228B</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Special Fire Hazards</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of fire hazards, emergency response procedures and preventive measures associated with transportation and railway systems.
To develop understanding of marine, port and aviation fire safety systems, rescue operations and firefighting strategies.
To familiarize students with fire and explosion hazards in industrial occupancies, high-rise buildings and specialized hazardous environments.
To acquaint students with fire safety management, evacuation strategies, firefighting challenges and safety measures related to complex infrastructures and nuclear facilities.</td></tr>
<tr><td>Assessment</td><td colspan="5">30 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">45 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the terminology and standards related to transportation, industrial, building, and nuclear fire safety.	Level 1: Remember
CO2	Explain the fire protection systems, firefighting operations, evacuation procedures and safety management practices used in different hazardous occupancies and infrastructures.	Level 2: Understand
CO3	Apply fire safety principles and emergency response concepts for management of fire and explosion hazards in transportation, industrial, marine, aviation and high-rise building environments.	Level 3: Apply
CO4	Analyze fire risk scenarios, operational challenges and mitigation strategies associated with complex fire emergencies and hazardous installations.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 1.5 marks each and remaining eight questions of 9 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Transportation Safety: Fundamentals of transportation fire safety, Passenger and commercial vehicle fires, Hazardous material transportation, MSDS, HAZCHEM code, Placards and TREM cards, LNG/LPG

transportation hazards, Electric vehicle and lithium-ion battery fire hazards, Emergency response procedures, Preventive measures and case studies.

Trains Safety: Structural features of trains, Railway stations, Tunnels and metro rail systems, Railway fire hazards, Passenger evacuation, Tunnel fire safety, Rescue operations, Emergency response strategies and case studies.

Unit-II

Marine and Port Fire Safety: The maritime environment, Types of vessels, Constructional features of passenger and cargo ships, Fire detection and suppression systems in ships, Cargo hazards and safety measures, Marine firefighting and rescue operations, emergency planning, Preventive measures and strategic management, Fire protection facilities for ports handling hydrocarbons as per OISD-STD-156,Ships and marine technology, Fire extinguishing systems for protection of galley cooking equipment as per IS 17564,Ships and Marine technology windows and side scuttles for fire-resistant constructions as per IS 18280,Shipbuilding testing, Installation and maintenance of marine portable fire appliances- Code of practice as per IS3947, Loading and unloading hazards, Firefighting systems in ports and terminals, Emergency response systems, Preventive measures and case studies.

Unit-III

Aviation Fire Safety: Constructional features of aircraft, Aircraft fire hazards, Air crashes and emergency landings, Rescue operations in aircraft fires, Airport fire hazards, Hangar protection systems, Crash fire tenders and rapid intervention vehicles, Airport categorization and firefighting appliances as per international standards and case studies.

Industrial and High-Rise Fire Safety: Fire safety in iron and steel industries, Petroleum refineries, Fertilizer plants, Pharmaceutical industries, Coal-based industries and thermal power plants, Hydrogen hazards, Bleve, Vapor cloud explosions, Rocket propellants, Industrial emergency response procedures, Preventive measures and case studies.

Unit-IV

Building Fire Safety: Fundamentals of fire-safe building design, Life safety systems for high-rise buildings, Structural fire protection, Alarm and signaling systems, Smoke movement and smoke control systems, Refuge areas, Fire lifts, Façade fire hazards, Evacuation strategies, Firefighting challenges in high-rise buildings and case studies**.**

Nuclear Safety: Radiation and its types, Nuclear reactors, Radiation emergencies, Firefighting and rescue operations in radiation hazard areas, Radiation safety measures, Radioactive waste management, Nuclear accidents, Mitigation measures and strategic management.

Suggested Readings:

- Radioactive Materials by B.M. Rao, Himalaya Publishing House.
- Fire Safety in Buildings by V K Jain, New Age Publishers, New Delhi.
- Indian Buildings Congress Manual of Fire Safety in Buildings by Indian Building Congress, Nabhi Publication
- Industrial Safety, Health and Environment Management Systems by R. K. Jain and Sunil S. Rao,Khanna Publishers
- Handbook on Fire and Life Safety in Buildings by Barendra Mohan Sen, Techno World
- Airport, Aircraft and Aviation Fire Safety by P. K. Sarkar,S. K. Kataria and Sons
- Marine Fire Prevention, Firefighting and Fire Safety by D. K. Gupta,CBS Publishers and Distributors
- Relevant OISD Standard

~~Annexure 4.6~~

Annexure AC/5.31

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute
'A' GRADE ACCREDITED BY NAAC

Scheme of Examinations & Syllabus

For

Minor Degree

in

Sustainable Energy Engineering

Department of Fire Technology and Safety

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

Minor Degree in Sustainable Energy Engineering

w.e.f. 2026-27

Sr. No.	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	MFTSE201B	Sustainable Engineering Concepts	3	0	0	3	3	25	50		75	3
2	IV	MFTSE202B	Energy and its Resources	3	0	0	3	3	25	50		75	3
3	IV	MFTSE204B	Sustainable Engineering Lab	0	0	2	2	1	10		15	25	3
4	V	……	Refer Table-I	3	0	0	3	3	25	50		75	3
5	VI	……	Refer Table-II	3	0	0	3	3	25	50		75	3
6	VI	MFTSE302B	Project	0	0	4	4	2	20		30	50	3
7	VII	MFTSE401B	Sustainable Energy Policy	3	0	0	3	3	25	50		75	3
Total Credits								**18**				**450**	

Note: The students have to choose one course from Table-I and one from Table-II. The elective course offered by the department will be mandatory. However, any relevant MOOCs/Swayam Course with the prior approval of Head of Department/Chairperson BOS can be chosen.

Table I Professional Elective – I

Sr. No.	Code	Subject
1	MFTSE301B	Electronics for Energy Engineering
2	MFTSE303B	Climate Change Understanding and Observations
3	MFTSE305B	Energy Storage System for Renewables
4	MFTSE307B	Renewable Energy Technologies
5	MFTSE309B	Hydrogen and Fuel Cell Technology
6	MFTSE311B	Any one MOOCS/Swayam Course

Table II Professional Elective – II

Sr. No.	Code	Subject
1	MFTSE304B	Sustainable Buildings
2	MFTSE306B	Energy Management and Audit
3	MFTSE308B	Energy Conservation and Waste Heat Recovery
4	MFTSE310B	Smart Grid and Energy Systems
5	MFTSE312B	Solar Energy Technologies and System Design
6	MFTSE314B	Any one MOOCS/Swayam Course

Course Code	**MFTSE201B**				
Category	Core Courses				
Course Title	**Sustainable Engineering Concepts**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To familiarize the students with the fundamental concepts of sustainability, sustainable development, and their significance in engineering practice. • To develop an understanding of environmental resources, sustainability challenges, environmental impacts, and sustainable engineering approaches. • To make the students learn about life cycle thinking, circular economy principles, and resource-efficient engineering practices. • To enable students to appreciate the role of engineers in addressing environmental, economic, and social dimensions of sustainability through responsible decision-making.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, principles, frameworks and terminology related to sustainability, sustainable development, environmental resources, life cycle thinking, circular economy, and sustainable engineering.	Level 1: Remember
CO2	Explain the interrelationships among environmental, economic and social dimensions of sustainability, resource utilization, environmental impacts, life cycle approaches, and sustainable engineering practices.	Level 2: Understand
CO3	Apply sustainability principles, life cycle thinking, resource efficiency concepts and sustainability assessment approaches to engineering systems and practices.	Level 3: Apply
CO4	Analyze engineering systems, processes, and development practices with respect to sustainability indicators, environmental impacts, resource utilization and circular economy principles to support sustainable decision-making.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Sustainability and Sustainable Development: Introduction to sustainability, Evolution of sustainability concepts, Sustainable development and its importance, Three pillars of sustainability (Environmental, Economic and social dimensions), Sustainable development goals (SDGs), Role of engineers in sustainable development, Resource depletion and environmental challenges,

Population growth, Urbanization and industrialization, Sustainability challenges in developing countries, Water-Energy-Food nexus.

Unit II

Environment, Resources and Sustainable Engineering: Natural resources and their utilization, Renewable and non-renewable resources, Environmental degradation and pollution, Climate change and global warming, Carbon footprint and ecological footprint, Environmental legislation and policies, Principles of green engineering, Sustainable consumption and production, Industrial ecology, Cleaner production technologies, Environmental management systems and ISO 14001 framework.

Unit-III

Life Cycle Thinking and Circular Economy: Introduction to life cycle thinking, Life cycle assessment (LCA), Stages of LCA—Goal and scope definition, Life cycle inventory, Life cycle impact assessment and interpretation, Material flow analysis, Environmental risk assessment, Circular economy principles, Reduce, Reuse, Recycle and recovery strategies, Sustainable materials and green products, Waste minimization and resource efficiency, Case studies on sustainable engineering practices.

Unit-IV

Sustainable Design and Engineering Applications: Sustainable design principles, Design for environment (DfE), Sustainable manufacturing and green technologies, Sustainable buildings and infrastructure, Energy-efficient systems, Renewable energy integration, Sustainable transportation systems, Sustainability indicators and assessment tools, Economic evaluation of sustainable projects, Case studies on sustainable engineering solutions in energy, Construction and industry.

Suggested Readings:

- Sustainable Engineering: Concepts, Design and Case Studies by Allen, D. T. and Shonnard, D. R., Prentice Hall.
- Environmental Engineering: Fundamentals, Sustainability and Design by Mihelcic, J. R. and Zimmerman, J. B., Wiley.
- Introduction to Sustainable Engineering by Bradley, A. S., Adebayo, A. O. and Maria, P., CRC Press.
- Industrial Ecology and Sustainable Engineering by Graedel, T. E. and Allenby, B. R., Pearson.
- Sustainable Solutions: Developing Products and Services for the Future by Martin Charter and Ursula Tischner, Greenleaf Publishing.
- Sustainable Engineering Concepts and Life Cycle Analysis by Brajesh Kumar Dubey, NPTEL Course Material, IIT Kharagpur.
- Sustainable Development in Practice: Case Studies for Engineers and Scientists by Azapagic, A., Perdan, S., and Clift, R., Wiley.
- Sustainable Design: The Science of Sustainability and Green Engineering by Daniel A. Vallero and Chris Brasier, Wiley.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Sustainability and Sustainable Development - Part A	https://youtu.be/oIF9EWyJ2_w?si=grDpXDnGRFk44iZy	NPTEL (IIT Guwahati)
Unit-II	Climate and climate change	https://youtu.be/fB9eBKP3Wm0?si=5i8R5ci5uUH19UOx	NPTEL (IIT Roorkee)

Unit-III	Introduction to Life Cycle Assessment (LCA)	https://youtu.be/j_oIVexNdu0?si=Yg8ogFiUTrr2Hgxl	NPTEL (IIT Roorkee)
Unit-IV	Introduction to Transportation Systems-I	https://youtu.be/IYZA06kRktw?si=c6W5KpRXL7Kp6OwP	NPTEL (IIT Roorkee)

Course Code	**MFTSE202B**				
Category	Core Courses				
Course Title	**Energy and its Resources**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To familiarize the students with the fundamental concepts of energy, power, energy resources, and the global and national energy scenario. • To develop an understanding of conventional and renewable energy resources, their availability, utilization, and role in meeting future energy demands. • To make the students learn about the environmental impacts of energy systems and the significance of sustainable energy development. • To enable students to appreciate the role of energy resource management and sustainable energy planning in addressing energy and environmental challenges.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, terminology, energy resources, energy systems, environmental aspects, and economic parameters associated with conventional and renewable energy technologies.	Level 1: Remember
CO2	Explain the characteristics, utilization, potential, and limitations of conventional and renewable energy resources along with their significance in the energy sector.	Level 2: Understand
CO3	Apply principles of energy resource assessment, energy efficiency, sustainability concepts, and economic evaluation methods to energy systems and projects.	Level 3: Apply
CO4	Analyze energy resources, energy systems, environmental implications, and economic factors to support informed decision-making for sustainable energy planning and development.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Energy Scenario and Conventional Energy Resources: Introduction to energy and power, Forms of energy and units, Global and Indian energy scenario, Energy demand and supply trends, Energy consumption patterns, Energy security, Classification of energy resources, Conventional energy resources, Coal, Petroleum and natural gas—Origin, Reserves, Extraction, Processing and utilization, Fossil fuel-Based power generation, Energy flow diagrams and energy balance, Resource depletion and future energy challenges.

Unit II

Renewable Energy Resources: Need for renewable energy, Solar energy resource and potential, Wind energy resource assessment, Hydropower resources and applications, Biomass and bioenergy systems, Geothermal energy, Ocean energy (tidal, wave and OTEC), Hydrogen as an energy carrier, Resource assessment methodologies, Renewable energy potential in India, Opportunities and challenges of renewable energy deployment.

Unit-III

Energy, Environment and Sustainability: Environmental impacts of energy production and utilization, Air, Water and soil pollution due to energy systems, Greenhouse gases and global warming, Climate change and energy sector, Carbon footprint and emission factors, Energy efficiency and conservation, Sustainable energy development, Environmental impact assessment of energy projects, International environmental agreements and climate initiatives, Role of renewable energy in sustainable development.

Unit-IV

Energy Economics and Project Evaluation: Principles of energy economics, Energy pricing and energy markets, Energy demand forecasting, Economic evaluation of energy projects, Simple payback period, Discounted cash flow, Net present value (NPV), Internal rate of return (IRR), Benefit-cost ratio, Levelized cost of energy (LCOE), Life cycle costing, Financing of energy projects, Case studies of renewable energy and sustainable energy projects.

Suggested Readings:

- Renewable Energy Resources by Twidell, J. and Weir, T., 4th Edition, Routledge.
- Renewable Energy: Power for a Sustainable Future by Boyle, G.,Oxford University Press.
- Energy and the Environment by Ristinen, R. A., Kraushaar, J. J. and Brack, M. C.,Wiley.
- Solar Energy: Principles of Thermal Collection and Storage by Sukhatme, S. P. and Nayak, J. K.,McGraw Hill.
- Renewable Energy and Sustainability by Khan, I.,Elsevier.
- Renewable Energy Engineering and Technology: Principles and Practice byKishore, V. V. N., Earthscan.
- Financial Evaluation of Renewable Energy Technologies by Kandpal, T. C. and Garg, H. P., Macmillan India.
- Sustainable Energy: Choosing Among Options byTester, J. W. et al.,MIT Press.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Introduction to Fossil Fuels	https://youtu.be/3cYVEFHBF1Q?si=cSgOsG6eSIEwLjYe	NPTEL (IIT Roorkee)
Unit-II	Solar Energy: An overview of thermal applications	https://youtu.be/iZyzvDj6Y3c?si=E6jFQTviJBbVETqa	NPTEL (IIT Guwahati)
Unit-III	Carbon Footprint	https://youtu.be/r1Li7Dh0Xh4?si=HZ7sQ2d9a7WoBGEZ	NPTEL (IIT Kanpur)
Unit-IV	Energy Economics-I	https://youtu.be/XfRtl1DHqgU?si=-KmfNhsQb22PA90a	NPTEL (IIT Roorkee)

Course Code	**MFTSE204B**				
Category	Core Courses				
Course Title	**Sustainable Engineering Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To familiarize the students with experimental techniques and measurement methods used in sustainability assessment and renewable energy systems. • To develop an understanding of sustainability indicators, carbon footprint, ecological footprint, and life cycle assessment methodologies. • To make the students learn about the performance evaluation of renewable energy technologies, including solar, wind, battery, and fuel cell systems. • To enable students to appreciate the practical implementation of sustainable engineering solutions for environmental protection, energy conservation, and sustainable development.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the principles, operating characteristics, assessment procedures, and performance evaluation methods associated with sustainable energy technologies and sustainability indicators.	Level 2: Understand
CO2	Apply standard measurement techniques, assessment methodologies, and performance evaluation procedures for renewable energy systems, energy-efficient technologies, and sustainability studies.	Level 3: Apply
CO3	Analyze experimental data, system performance, energy utilization patterns, sustainability metrics, and environmental impacts to support sustainable engineering decision-making.	Level 4: Analyze
CO4	Evaluate the effectiveness of energy management, renewable energy, and sustainability interventions in achieving resource conservation and environmental protection goals.	Level 5: Evaluate

List of Experiments

Sr. No.	**Contents**
1	Study of sustainable development goals (SDGs) and sustainability indicators.
2	Estimation of carbon footprint of a household/building.
3	Determination of ecological footprint using standard assessment methods.
4	Energy audit of a classroom, Laboratory or Residential building.
5	Measurement of solar radiation using a pyranometer and analysis of solar insolation data.
6	Study of solar photovoltaic (PV) module characteristics (I–V and P–V curves).

7	Determination of efficiency of a solar photovoltaic panel under varying conditions.
8	Performance analysis of solar water heating system. Solar irradiance measurement, PV module testing and thermal system evaluation are common learning outcomes in renewable energy laboratories.
9	Assessment of wind energy potential using an anemometer and wind data analysis.
10	Study of battery charging and discharging characteristics for renewable energy storage.
11	Demonstration and performance analysis of fuel cell systems.
12	Study of hybrid renewable energy systems (solar–battery or solar–wind models). Renewable energy laboratories commonly include wind turbines, Fuel cells, Batteries and hybrid systems for practical training.
13	Energy efficiency analysis of lighting systems (LED, CFL, Incandescent).
14	Life cycle assessment (LCA) of a selected product or engineering system.
15	Comparative study of renewable and conventional energy systems based on environmental impacts.
16	Mini project on sustainable engineering solutions for campus/community applications.

Note:At least 10 experiments to be performed from the above list and other experiment can be performed depending upon the scope of course as decided by the department.

Course Code	**MFTSE301B**				
Category	Elective Courses				
Course Title	**Electronics for Energy Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To familiarize the students with the fundamentals of electronic devices and power semiconductor components used in energy conversion and renewable energy systems. • To develop an understanding of power electronic converters, switching principles, and their role in efficient energy conversion and control. • To make the students learn about DC-DC converters, power conditioning techniques, and energy management applications in renewable energy systems. • To enable students to appreciate the role of advanced power electronic technologies in sustainable energy systems, smart grids, electric vehicles, and microgrids.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, characteristics, components, and terminology associated with power electronic devices, converters, photovoltaic systems, energy storage systems and renewable energy integration.	Level 1: Remember
CO2	Explain the operating principles and performance characteristics of power semiconductor devices, power converters, solar power conditioning systems and renewable energy interfaces.	Level 2: Understand
CO3	Apply the principles of power conversion, converter operation, photovoltaic power conditioning, and energy management techniques in renewable energy systems.	Level 3: Apply
CO4	Analyze the performance of power electronic systems, renewable energy interfaces, energy storage technologies, and grid-connected systems with respect to efficiency, control, reliability and power quality.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Electronic Devices and Power Semiconductor Components: Introduction to electronics in sustainable energy systems, Role of electronics in energy conversion and control, Semiconductor fundamentals, Diodes, Power diodes, SCRs, MOSFETs, IGBTs and their characteristics, Switching principles, Power losses and efficiency, Gate drive circuits, Protection of power electronic devices, Introduction to power

electronic systems used in renewable energy applications, Power electronic devices form the basis of renewable energy conversion systems and grid integration technologies.

Unit-II

DC-DC Converters and Energy Conversion: Principles of power conversion, Rectifiers and controlled rectifiers, DC-DC converters—Buck, Boost, Buck-Boost and Cuk converters, Operating principles, Circuit configurations and performance characteristics, Converter efficiency, Design considerations, Bidirectional converters for battery charging and energy storage applications, Applications in solar PV and renewable energy systems, DC-DC conversion is central to PV systems, Storage integration and energy management.

Unit-III

Solar Power Electronics and MPPT Techniques: Solar photovoltaic characteristics, PV cell, Module and array configurations, I-V and P-V characteristics, Effect of temperature and irradiance, Maximum power point concept, Maximum power point tracking (MPPT) techniques—Perturb & Observe, Incremental conductance and hill climbing methods, Charge controllers—Simple, PWM and MPPT controllers, Battery charging systems, Solar inverters—Off-grid, Grid-connected and Hybrid inverters, Performance evaluation of solar power conditioning systems, MPPT and inverter technologies are key components in modern photovoltaic systems.

Unit-IV

Power Electronics for Renewable Energy Integration: Power electronic interfaces for wind energy systems, Rectifiers and inverters in wind power generation, Battery management systems (BMS), Microgrids and distributed generation, Grid synchronization and power quality, Smart converters, Electric vehicle charging systems, Vehicle-to-grid (V2G) concept, Monitoring, Protection and control of renewable energy systems, Emerging trends in power electronics for sustainable energy applications, Renewable energy integration increasingly depends on advanced converters, Storage systems and microgrid control technologies.

Suggested Readings:

- Power Electronics: Circuits, Devices and Applications by Rashid, M. H., Pearson Education.
- Fundamentals of Power Electronics by Erickson, R. W. and Maksimovic, D.,Springer.
- Solar Photovoltaics: Fundamentals, Technologies and Applications by Solanki, C. S., PHI Learning.
- Power Electronics for Renewable and Distributed Energy Systems by Chakraborty, S., Simões, M. G. and Kramer, W. E., Springer.
- Grid Converters for Photovoltaic and Wind Power Systems by Teodorescu, R., Liserre, M. and Rodriguez, P.,Wiley-IEEE Press.
- Advanced DC/AC Inverters: Applications in Renewable Energy by Luo, F. L. and Ye, H., CRC Press.
- Modern Power Electronics and AC Drives by Bimal K. Bose, Pearson.
- Power Electronics: Converters, Applications and Design by Mohan, N., Undeland, T. M. and Robbins, W. P.,Wiley.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Types of Semiconductors	https://youtu.be/MovJj2ldIH0?si=1rGAK5CphMrpo6vr	NPTEL (IIT Madras)
Unit-II	DC-DC converters	https://youtu.be/TxgMCGX6ioU?si=3ZjeUfLedoO5MbfR	NPTEL (IISC Bangalore)
Unit-III	Solar Photovoltaics: Principles, Technologies & Materials	https://youtu.be/k-IJ7ulxWe4?si=DVcaHABXQvAyVnic	NPTEL (IIT Kanpur)
Unit-IV	Overview of Electric Vehicles in India	https://youtu.be/3E1SXG7VkQk?si=B5790Dzd1k79gAPO	NPTEL (IIT Madras)

Course Code	**MFTSE302B**				
Course Title	**Project**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	4	2	
Assessment	20 Marks				
End Semester Practical Examination	30Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

The students expected to take up a project under the guidance of teacher from the college. The Project must be based on Sustainability Engineering/Fire Technology and Safety Engineering problems. The students may be asked to work individually or in a group normally not more than three students in a group (if any large/ big projects occur then strength of student's can be increased as per guide supervision). Viva-voce must be based on the preliminary reports submitted by the students related to the project.

Course Code	**MFTSE303B**				
Category	Elective Courses				
Course Title	**Climate Change Understanding and Observations**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To familiarize the students with the fundamental concepts of climate, climate systems and the scientific basis of climate change. • To develop an understanding of climate processes, climate observations and the evidence supporting climate variability and climate change. • To make the students learn about climate drivers, climate modeling approaches and future climate projections used in climate science and planning. • To enable students to appreciate the role of climate science, policy frameworks and international initiatives in addressing climate change challenges.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, terminology, processes, indicators, drivers, models, impacts, adaptation measures, mitigation approaches and policy frameworks related to climate science and climate change.	Level 1: Remember
CO2	Explain the interactions among climate system components, climate variability, climate observations, climate drivers and climate change processes at regional and global scales.	Level 2: Understand
CO3	Apply climate data, climate indicators, climate model outputs, and climate risk concepts for understanding climate variability, impacts and future climate conditions.	Level 3: Apply
CO4	Analyze climate change drivers, observational evidence, projected climate scenarios, climate risks and policy responses to support informed decision-making for sustainable development.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Climate System and Climate Change: Weather and climate, Elements of climate, Earth's climate system—Atmosphere, Hydrosphere, Cryosphere, Lithosphere and biosphere, Solar radiation and earth's energy balance, Greenhouse effect, Carbon cycle, Climate forcing mechanisms, Natural climate variability and anthropogenic climate change, Historical evolution of climate science, Climate change terminology and concepts, Understanding climate requires knowledge of earth's energy balance, Atmospheric processes and interactions among earth systems.

Unit II

Climate Observations and Evidence of Climate Change: Climate observation systems, Meteorological stations, Satellites and remote sensing, Climate datasets and indicators, Temperature records, Precipitation trends, Sea level rise, Glacier retreat, Ocean warming, Extreme weather events, Detection and attribution of climate change, Interpretation of observational records, Role of the IPCC in climate assessment, Uncertainties in climate observations, Modern climate science relies on observational evidence and attribution studies to distinguish natural variability from human-induced change.

Unit-III

Climate Variability, Modelling and Future Projections: Climate variability and climate drivers, El Niño and La Niña phenomena, Monsoon variability, Climate feedback mechanisms, Tipping points, Fundamentals of climate modeling, Climate scenarios and emission pathways, Climate projections, Interpretation of climate model outputs, Regional and global climate projections, Uncertainty analysis, Applications of climate models in planning and decision-making, Climate models help understand future climate conditions and evaluate potential impacts of emissions and mitigation pathways.

Unit-IV

Climate Change Impacts, Adaptation and Mitigation: Impacts of climate change on water resources, Agriculture, Ecosystems, Biodiversity, Human health, Energy systems and infrastructure, Climate risks and vulnerabilities, Adaptation strategies and resilience building, Mitigation approaches, Carbon management, Renewable energy and climate action, International climate agreements—UNFCCC, Kyoto Protocol and Paris Agreement, India's climate initiatives and national action plan on climate change (NAPCC), Sustainable development and climate policy, Climate studies increasingly integrate science, Adaptation, Mitigation and policy responses.

Suggested Readings:

- Atmosphere, Weather and Climate by Barry, R. G. and Chorley, R. J., Routledge.
- Introduction to Modern Climate Change by Dessler, A. E., Cambridge University Press.
- Global Warming: Understanding the Forecast by Archer, D., Wiley.
- Climate Change Assessment Reports (AR6 and subsequent reports), IPCC.
- Climate Change: A Very Short Introduction by Maslin, M., Oxford University Press.
- Contemporary Climatology by Henderson-Sellers, A. and Robinson, P. J., Pearson.
- The New Climate War by Mann, M. E., Public Affairs.
- Earth's Climate: Past and Future by Ruddiman, W. F., W.H. Freeman.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Basics of Carbon Cycle	https://youtu.be/dBWwEdoTf7U?si=35SK0NqhsXgyYz7f	NPTEL (IIT Delhi)
Unit-II	Role of the IPCC in climate assessment	https://youtu.be/4qhZyT6guG4?si=4RM5WDkaV3vuttm1	NPTEL (IIT Kharagpur)
Unit-III	Climatic variables of the atmosphere	https://youtu.be/5tVWXsbe-Uk?si=I8DqaublfLCkQo4I	NPTEL (IIT Madras)
Unit-IV	Biodiversity	https://youtu.be/SHxAOoxhKTA?si=gWGkdpXTmV_Xt_1H	NPTEL (IIT Kanpur)

<table>
<tr><td>Course Code</td><td colspan="5">MFTSE304B</td></tr>
<tr><td>Category</td><td colspan="5">Electives Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Sustainable Buildings</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To familiarize the students with the principles, concepts, and significance of sustainable buildings and sustainable development in the built environment.
To develop an understanding of climate-responsive architecture, passive design strategies and energy-efficient building design practices.
To make the students learn about sustainable construction materials, resource-efficient construction techniques and environmentally responsible building practices.
To enable students to appreciate the role of sustainable building design, construction and operation in reducing environmental impacts and promoting sustainable development.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, principles, terminology, materials, systems, assessment methods and rating frameworks associated with sustainable buildings and green construction practices.	Level 1: Remember
CO2	Explain the relationships among sustainable building design, energy efficiency, resource conservation, indoor environmental quality and environmental performance in the built environment.	Level 2: Understand
CO3	Apply sustainable building design principles, energy conservation measures, resource-efficient practices and building performance assessment approaches to building systems and projects.	Level 3: Apply
CO4	Analyze building designs, construction practices, resource utilization patterns, environmental impacts, and building performance indicators to support sustainable decision-making in the built environment.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Sustainable Buildings: Introduction to sustainable development in the built environment,Concept and objectives of sustainable buildings,Environmental impacts of buildings,Sustainable construction principles,Life cycle approach in buildings,Site selection and sustainable site planning,Climate-responsive architecture,Building orientation,Passive design concepts,Sustainable building design process,Role of sustainable buildings in achieving Sustainable Development Goals (SDGs).

Unit-II

Energy-Efficient Building Design and Building Envelope: Building energy consumption patterns,Heat transfer in buildings,Thermal comfort and indoor environmental quality,Building envelope design,Walls, roofs, windows and insulation materials,Passive solar heating and cooling techniques,Daylighting strategies,Natural ventilation systems,Energy-efficient lighting systems, HVAC systems and energy conservation measures, Energy Conservation Building Code (ECBC) and its provisions.

Unit-III

Sustainable Materials, Water Management and Green Construction: Sustainable construction materials, Embodied energy of building materials, Recycled and eco-friendly materials, Low-carbon construction technologies, Construction waste management, Resource-efficient construction practices.

Water conservation in buildings, Rainwater harvesting, Greywater recycling, Wastewater treatment and reuse, Water-efficient fixtures and appliances, Sustainable landscaping and stormwater management, Green roofs and green walls.

Unit-IV

Green Building Rating Systems and Building Performance Assessment: Green building certification systems, LEED (Leadership in Energy and Environmental Design), GRIHA (Green Rating for Integrated Habitat Assessment), IGBC Green Building Rating System,Net-zero energy buildings,Energy auditing of buildings,Building energy simulation concepts,Building performance assessment,Life cycle cost analysis,Carbon footprint assessment of buildings,Case studies of sustainable buildings in India and abroad.

Suggested Readings:

- Sustainable Construction: Green Building Design and Delivery by Kibert, C.J., Wiley.
- Green Building Through Integrated Design by Yudelson, J., McGraw Hill.
- Sustainable Construction and Building Design by Charles J. Kibert, Wiley.
- Energy Audit of Building Systems: An Engineering Approach by Krarti, M., CRC Press.
- Climate Considerations in Building and Urban Design by Givoni, B., Wiley.
- Sustainable Construction by Halliday, S., Butterworth-Heinemann.
- GRIHA Manual, Green Rating for Integrated Habitat Assessment, TERI.
- ECBC Manual, Energy Conservation Building Code, Bureau of Energy Efficiency (BEE), Government of India.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-II	Introduction to HVAC	https://youtu.be/xMkgzVR1Luo?si=Z0x1-_gMVGGQekF_	NPTEL (IIT Delhi)
Unit-III	Rainwater Harvesting & Roof Catchment System	https://youtu.be/QewEi2U1jLs?si=h3bBGqhtBaI8pLaY	NPTEL (IIT Bombay)
Unit-IV	Energy Audit: Case Studies	https://youtu.be/BrBBneXpIjk?si=KuoZXq7F-oLed_C8	NPTEL (IIT Kanpur)

Course Code	**MFTSE305B**				
Category	Electives Courses				
Course Title	**Energy Storage System for Renewables**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To familiarize the students with the fundamentals, characteristics, and significance of energy storage systems in modern energy infrastructure. • To develop an understanding of the role of energy storage technologies in renewable energy integration, grid stability, and energy management. • To make the students learn about electrochemical, mechanical, thermal, and hydrogen-based energy storage technologies and their operating principles. • To enable students to appreciate the techno-economic, environmental, and sustainability aspects of energy storage systems and emerging storage technologies.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the fundamental concepts, terminology, classifications, characteristics, technologies and applications associated with energy storage systems and renewable energy integration.	Level 1: Remember
CO2	Explain the operating principles, performance characteristics, and functional requirements of electrochemical, mechanical, thermal and hydrogen energy storage systems.	Level 2: Understand
CO3	Apply the principles of energy storage technologies, energy management practices, and system integration approaches to renewable energy, microgrid, smart grid and electric vehicle applications.	Level 3: Apply
CO4	Analyze the performance, reliability, techno-economic feasibility, environmental implications, and integration aspects of energy storage systems for sustainable energy applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Energy Storage Systems: Introduction to energy storage,Need for energy storage in renewable energy systems,Energy storage requirements for solar and wind power integration,Energy storage characteristics,Power rating, Energy density, Efficiency, Cycle life, Reliability and safety,Classification of energy storage systems,Grid-scale and distributed energy storage,Applications in renewable energy systems, Electric vehicles and microgrids.

Unit-II

Electrochemical Energy Storage Systems: Principles of electrochemical energy storage,Primary and secondary batteries,Lead-acid batteries,Nickel-cadmium batteries,Nickel-metal hydride batteries,Lithium-ion batteries and advanced lithium battery technologies,Sodium-sulfur batteries,Flow batteries,Battery performance characteristics,Charging and discharging processes,Battery degradation mechanisms,Battery safety considerations.

Unit-III

Mechanical, Thermal and Hydrogen Energy Storage: Mechanical energy storage systems: pumped hydro energy storage, Compressed Air Energy Storage (CAES), Flywheel energy storage systems, Thermal energy storage: Sensible heat storage, Latent heat storage, Phase change materials, Thermochemical storage, Hydrogen energy storage: Hydrogen production, Storage methods, Fuel cells, Hydrogen economy, Comparative analysis of storage technologies for renewable energy integration.

Unit-IV

Energy Storage Applications and System Integration: Battery Management Systems (BMS), Energy management strategies, Hybrid energy storage systems, Integration of storage with solar photovoltaic and wind energy systems, Storage in microgrids and smart grids, Energy storage for electric vehicles, Techno-economic analysis of storage systems, Life cycle assessment, Emerging storage technologies, Case studies on renewable energy storage projects.

Suggested Readings:

- Energy Storage: Systems and Components by Luo, X., Wang, J., Dooner, M., and Clarke, J., Wiley.
- Battery Energy Storage Technology for Sustainable Power Systems by Divya, K. C. and Østergaard, J., Springer.
- Thermal Energy Storage: Systems and Applications by Ibrahim Dincer and Marc A. Rosen, Wiley.
- Energy Storage for Power Systems by A.G. Ter-Gazarian, IET Publications.
- Renewable Energy Conversion, Transmission and Storage by Bent Sørensen, Academic Press.
- Energy Storage by Robert Huggins, Springer.
- Handbook of Batteries by Linden, D. and Reddy, T.B., McGraw Hill.
- PEM Fuel Cells: Theory and Practice by FranoBarbir, Academic Press.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Need for Energy Storage	https://youtu.be/nmqbKCbjArI?si=Ljw4s9NAXBjGb0X3	NPTEL (IIT Kanpur)
Unit-II	Lithium Ion Battery	https://youtu.be/no4vRKvKxcU?si=CIrSjGOVBDohzbuI	NPTEL (IIT Kharagpur)
Unit-III	Fuel cells technologies - Part I	https://youtu.be/Eb7pv0oOf_k?si=alifMYpefoAxEv7Y	NPTEL (IIT Guwahati)

Course Code	**MFTSE306B**				
Category	Electives Courses				
Course Title	**Energy Management and Audit**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To familiarize the students with the concepts, principles, and practices of energy management and energy conservation in various sectors. • To develop an understanding of energy resources, energy utilization patterns, energy performance indicators, and benchmarking techniques. • To make the students learn about energy auditing methodologies, audit procedures, measurement techniques, and economic evaluation of energy conservation projects. • To enable students to appreciate the role of energy management, energy auditing, and continuous performance improvement in achieving energy efficiency and sustainable development.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, terminology, methodologies, standards, indicators, and techniques associated with energy management, energy auditing, energy efficiency, and energy conservation.	Level 1: Remember
CO2	Explain the principles of energy management, energy auditing procedures, energy performance assessment methods, and energy conservation practices in various systems and sectors.	Level 2: Understand
CO3	Apply energy auditing methodologies, energy performance assessment techniques, and energy management principles to identify opportunities for energy conservation and efficiency improvement.	Level 3: Apply
CO4	Analyze energy consumption patterns, energy performance data, audit findings, economic feasibility parameters, and energy management practices to support sustainable energy decision-making.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Energy Management: Energy scenario: Global and Indian perspective,Energy resources and utilization,Energy conservation and its importance,Principles of energy management,Energy

policy and energy planning,Energy management programs,Role and responsibilities of energy managers,Energy accounting and monitoring,Energy Performance Indicators (EnPIs),Benchmarking of energy consumption,Energy efficiency and sustainability.

Unit-II

Energy Audit Methodology: Introduction to energy auditing,Objectives and benefits of energy audits,Types of energy audits—preliminary audit, detailed audit and investment-grade audit,Audit methodology,Audit instruments and measurements,Data collection and analysis,Energy balance and material balance,Identification of energy losses,Preparation of audit reports,Economic evaluation of energy conservation projects,Simple payback period, Net Present Value (NPV), Internal Rate of Return (IRR) and life cycle costing.

Unit-III

Energy Efficiency in Utilities and Building Systems: Energy-efficient electrical systems, Motors and motor efficiency improvement,Transformers and power factor correction,Lighting systems and energy-efficient lighting technologies, HVAC systems and energy conservation,Boilers, Furnaces, Steam systems, Compressed air systems, Pumps and fans,Energy management in buildings, Energy Conservation Building Code (ECBC),Building energy performance assessment.

Unit-IV

Energy Conservation Opportunities and Energy Management Systems: Energy conservation opportunities in industrial, commercialand residential sectors,Waste minimization and resource optimization,Demand-side management,Renewable energy integration,Energy Management Systems (EnMS), ISO 50001 Energy Management Standard,Measurement and Verification (M&V),Carbon footprint reduction strategies,Case studies of successful energy management projects,Role of energy auditing in sustainable development.

Suggested Readings:

- Energy Management by W. R. Murphy and G. McKay, Butterworth-Heinemann.
- Guide to Energy Management by Barney L. Capehart, Wayne C. Turner and William J. Kennedy, CRC Press.
- Energy Efficiency for Engineers and Technologists by Eastop, T. D. and Croft, D. R., Longman.
- Energy Manager and Energy Auditor Guide Books, Bureau of Energy Efficiency (BEE), Volumes I–IV.
- Energy Management by Paul O'Callaghan, McGraw Hill.
- Energy Management Handbook by Wayne C. Turner, Fairmont Press.
- Energy Management Handbook by Doty, S. and Turner, W. C., Fairmont Press.
- Energy Management and Conservation Handbook by Kreith, F. and Goswami, D. Y., CRC Press.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Energy conservation and its importance	https://youtu.be/ubDMIAJydPc?si=jaYVvSx5SMsBLcva	NPTEL (IIT Guwahati)
Unit-II	Introduction to energy auditing	https://youtu.be/BrBBneXpIjk?si=svRS06m15nDLCtI1	NPTEL (IIT Kanpur)
Unit-III	HVAC systems and energy conservation	https://youtu.be/xMkgzVR1Luo?si=iKfek20XGHBzsbJQ	NPTEL (IIT Delhi)
Unit-IV	Carbon footprint	https://youtu.be/r1Li7Dh0Xh4?si=iDr04Ifs_98ok3Wt	NPTEL (IIT Kanpur)

<table>
<tr><td>Course Code</td><td colspan="5">MFTSE307B</td></tr>
<tr><td>Category</td><td colspan="5">Electives Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Renewable Energy Technologies</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To familiarize the students with the fundamentals of renewable energy resources, energy transition, and their significance in sustainable development.
To develop an understanding of the principles, technologies, and applications of solar, wind, hydropower, biomass, geothermal, and ocean energy systems.
To make the students learn about renewable energy resource assessment, energy conversion processes, and power generation technologies.
To enable students to appreciate the role of emerging renewable energy technologies, hydrogen energy systems, and policy frameworks in achieving sustainable energy goals.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts, terminology, resources, technologies, systems and applications associated with renewable energy and sustainable energy development.	Level 1: Remember
CO2	Explain the operating principles, resource characteristics, energy conversion processes and performance features of solar, wind, hydropower, biomass, geothermal, and ocean energy systems.	Level 2: Understand
CO3	Apply the principles of renewable energy resource assessment, energy conversion technologies and system integration approaches to renewable energy applications.	Level 3: Apply
CO4	Analyze renewable energy systems, resource potentials, environmental impacts, economic considerations and integration challenges to support sustainable energy planning and decision-making.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Renewable Energy and Solar Energy Systems: Global and Indian energy scenario,Need for renewable energy,Renewable and non-renewable energy resources,Sustainability and energy transition,Renewable energy potential in India,Solar radiation fundamentals,Solar geometry,Solar resource assessment,Solar thermal energy systems,Flat plate collectors, Evacuated tube collectors, Concentrating solar collectors,Applications of solar thermal systems,Introduction to solar photovoltaic systems and their applications.

Unit-II

Wind and Hydropower Technologies: Wind energy fundamentals,Wind characteristics and resource assessment,Wind energy conversion systems,Horizontal axis and vertical axis wind turbines, Betz limit, Components and operation of wind power plants,Offshore and onshore wind farms,Environmental aspects of wind energy, Hydropower systems, Hydrological cycle, Classification of hydroelectric plants, Micro, Mini and small hydropower systems,Components of hydropower plants,Pumped storage hydropower,Environmental and social impacts of hydropower development.

Unit-III

Biomass, Geothermal and Ocean Energy Technologies: Biomass resources and characteristics,Biomass conversion technologies,Combustion, Gasification, Pyrolysis, Anaerobic digestion and biogas production, Biofuels and biodiesel, Waste-to-energy technologies, Geothermal energy resources, Geothermal power plants and direct heating applications,Ocean energy technologies including tidal energy, wave energy, Ocean Thermal Energy Conversion (OTEC),Advantages, Limitations and applications of geothermal and ocean energy systems.

Unit-IV

Renewable Energy Integration and Emerging Technologies: Energy storage requirements for renewable energy systems, Integration of renewable energy with electrical grids, Hybrid renewable energy systems, Distributed generation and microgrids, Hydrogen energy and fuel cells,Smart renewable energy systems,Economics of renewable energy projects,Environmental impacts and life cycle assessment of renewable technologies, Policies, Incentives and future trends in renewable energy development.

Suggested Readings:

- Renewable Energy Resources by Twidell, J. and Weir, T., 4th Edition, Routledge.
- Renewable Energy: Power for a Sustainable Future by Boyle, G., Oxford University Press.
- Renewable Energy Engineering and Technology: Principles and Practice by Kishore, V. V. N., Earthscan.
- Solar Energy by Sukhatme, S. P. and Nayak, J. K., McGraw Hill Education.
- Solar Energy: Fundamentals and Applications by Garg, H. P. and Prakash, S., McGraw Hill.
- Renewable Energy: Technology, Economics and Environment by Kaltschmitt, M., Streicher, W., and Wiese, A., Springer.
- Renewable Energy and Sustainability by Khan, I., Elsevier.
- Non-Conventional Energy Sources by Rai, G. D., Khanna Publishers.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Solar Radiation	https://youtu.be/-I5O_kRzc3E?si=TKboTWIIZ7lBvnzx	NPTEL (IIT Kanpur)
Unit-II	Hydrological cycle	https://youtu.be/MBGBiBNeU6M?si=RGe1Xi8K9Md9iDzg	NPTEL (IIT Kanpur)
Unit-III	Characteristics and properties of biomass	https://youtu.be/L3AEXdvtIkk?si=14qNfh1Vb1Ev6HeT	NPTEL (IIT Guwahati)
Unit-IV	Fuel cells technologies - Part I	https://youtu.be/Eb7pv0oOf_k?si=yzgg_aByuCym-f1o	NPTEL (IIT Guwahati)

<table>
<tr><td>Course Code</td><td colspan="5">MFTSE308B</td></tr>
<tr><td>Category</td><td colspan="5">Electives Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Energy Conservation and Waste Heat Recovery</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To familiarize the students with the principles, significance, and practices of energy conservation in industrial and building sectors.
To develop an understanding of energy utilization patterns, energy efficiency measures, and energy conservation opportunities in various energy systems.
To make the students learn about energy conservation technologies and performance improvement techniques used in industrial utilities and electrical systems.
To enable students to appreciate the role of energy conservation, waste heat recovery, and emerging technologies in enhancing energy efficiency and reducing environmental impacts.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, terminology, principles, technologies, performance indicators, and economic parameters related to energy conservation and waste heat recovery systems.	Level 1: Remember
CO2	Explain the principles of energy conservation, energy-efficient utility systems, waste heat recovery technologies, and their role in improving energy performance and sustainability.	Level 2: Understand
CO3	Apply energy conservation principles, efficiency improvement techniques, and waste heat recovery approaches to industrial utilities, electrical systems, and process operations.	Level 3: Apply
CO4	Analyze energy utilization patterns, system losses, waste heat recovery opportunities, economic performance indicators, and environmental impacts to support energy-efficient and sustainable decision-making.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Energy Conservation: Energy scenario and energy utilization, Need for energy conservation, Principles of energy conservation, Energy efficiency and energy intensity, Energy conservation opportunities in industries and buildings, Energy performance indicators, Energy losses and their reduction, Energy conservation legislation and policies, Role of Bureau of Energy Efficiency (BEE), Perform, Achieve and Trade (PAT) scheme, Sustainable energy utilization and carbon emission reduction.

Unit-II

Energy Conservation in Industrial Utilities: Energy conservation in boilers and steam systems, Boiler efficiency improvement techniques, Steam distribution and condensate recovery, Energy-efficient furnaces and kilns, Compressed air systems and energy-saving measures, Pumps, Fans, Blowers and motors, Electrical energy conservation, Lighting system efficiency, Power factor improvement, Variable Frequency Drives (VFDs), Energy-efficient industrial practices and case studies.

Unit-III

Waste Heat Recovery Technologies: Introduction to waste heat and its sources, Classification of waste heat, Waste heat potential in industrial systems, Waste heat recovery principles, Heat exchangers and recuperators, Regenerators, Economizers, Waste heat boilers, Heat pipes, Thermal wheels, Thermoelectric generators, Organic Rankine Cycle (ORC), Cogeneration and Combined Heat and Power (CHP) systems, Selection criteria for waste heat recovery systems.

Unit-IV

Applications, Economic Analysis and Emerging Technologies: Waste heat recovery applications in cement, Steel, Glass, Chemical, Refinery, Power generation and process industries, District heating systems, Waste-to-energy concepts, Economic evaluation of energy conservation projects, Payback period, Net Present Value (NPV), Internal Rate of Return (IRR), Life cycle costing, Environmental benefits of waste heat recovery, Carbon footprint reduction, Emerging energy conservation technologies, Industrial case studies and best practices.

Suggested Readings:

- Energy Management and Conservation Handbook by Kreith, F. and Goswami, D. Y., CRC Press.
- Energy Efficiency for Engineers and Technologists by Eastop, T. D. and Croft, D. R., Longman Scientific & Technical.
- Energy Management Principles by Smith, C. B., Pergamon Press.
- Energy Manager and Energy Auditor Guide Books by Bureau of Energy Efficiency (BEE), Volumes I–IV.
- Handbook of Energy Audits by Thumann by A. and Younger, W. J., Fairmont Press.
- Heat Recovery Systems by Reay, D., McMichael, A., and Klemes, J., CRC Press.
- Energy Management Handbook by Turner, W. C. and Doty, S., Fairmont Press.
- Industrial Boilers and Heat Recovery Steam Generators by Ganapathy, V., CRC Press.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Energy scenario	https://youtu.be/19ruvTD65v8?si=ym_Bi3b1GHPYfo4c	NPTEL (IIT Guwahati)
Unit-III	Introduction to waste heat recovery (Contd.)2	https://youtu.be/UvYJzvK_8aE?si=eB_94s2lutWHhjyQ	NPTEL (IIT Kharagpur)
Unit-IV	Carbon Footprint	https://youtu.be/r1Li7Dh0Xh4?si=b-VJcp5ZNsJrrJQz	NPTEL (IIT Kanpur)

<table>
<tr><td>Course Code</td><td colspan="5">MFTSE309B</td></tr>
<tr><td>Category</td><td colspan="5">Electives Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Hydrogen and Fuel Cell Technology</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To familiarize the students with the fundamentals of hydrogen energy, hydrogen economy, and the role of hydrogen in sustainable energy systems.
• To develop an understanding of hydrogen production, storage, transportation, and distribution technologies used in modern energy applications.
• To make the students learn about various fuel cell technologies, their operating principles, performance characteristics, and applications.
• To enable students to appreciate the role of hydrogen energy systems, fuel cells, and emerging technologies in achieving decarbonization and carbon-neutral energy transitions.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, terminology, technologies, components, processes and applications associated with hydrogen energy systems, hydrogen storage and fuel cell technologies.	Level 1: Remember
CO2	Explain the principles of hydrogen production, storage, transportation, fuel cell operation and energy conversion processes in hydrogen-based energy systems	Level 2: Understand
CO3	Apply the principles of hydrogen production, storage technologies, fuel cell systems and renewable hydrogen integration to energy and transportation applications.	Level 3: Apply
CO4	Analyze hydrogen systems, fuel cell technologies, economic feasibility, environmental impacts, commercialization challenges and policy frameworks to support sustainable energy decision-making.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Hydrogen Energy Fundamentals: Introduction to hydrogen energy, Hydrogen as an energy carrier, Role of hydrogen in sustainable development, Global and Indian hydrogen scenario, Properties of hydrogen, Advantages and limitations of hydrogen energy, Hydrogen economy concept, Energy transition and decarbonization, Applications of hydrogen in transportation, Power generation, Industry and residential sectors, Future prospects of hydrogen technologies.

Unit-II

Hydrogen Production and Storage Technologies: Hydrogen production methods, Steam methane reforming, Coal gasification, Partial oxidation, Water electrolysis, Alkaline electrolysis, PEM electrolysis, Solid oxide electrolysis, Biomass-based hydrogen production, Biological hydrogen production methods, Green, Blue, Grey, and turquoise hydrogen. Hydrogen storage methods, Compressed gas storage, Liquid hydrogen storage, Cryogenic storage, Metal hydrides, Chemical hydrides, Adsorption-based storage, Hydrogen transportation and distribution systems, Safety aspects in hydrogen handling and storage.

Unit-III

Fuel Cell Technologies: Introduction to fuel cells, Principles of operation, Thermodynamics and electrochemistry of fuel cells, Fuel cell efficiency and performance parameters, Polarization characteristics. Types of fuel cells: Proton Exchange Membrane Fuel Cell (PEMFC), Alkaline Fuel Cell (AFC), Phosphoric Acid Fuel Cell (PAFC), Molten Carbonate Fuel Cell (MCFC), Solid Oxide Fuel Cell (SOFC), Direct Methanol Fuel Cell (DMFC), Fuel cell components, Fuel processing systems, Balance of plant, Performance evaluation and degradation mechanisms.

Unit-IV

Applications, Economics and Future Trends: Hydrogen-fuel cell integrated systems, Renewable hydrogen systems, Fuel cells for transportation, Stationary power generation, Portable power applications, Hydrogen-powered vehicles, Hydrogen refueling infrastructure, Fuel cell hybrid systems. Economic analysis of hydrogen energy systems, Life cycle assessment, Environmental benefits, Carbon neutrality and net-zero targets, Hydrogen policies and missions, National Green Hydrogen Mission (India),Challenges and opportunities in hydrogen commercialization, Emerging developments in hydrogen and fuel cell technologies.

Suggested Readings:

- PEM Fuel Cells: Theory and Practice by Barbir, F., Academic Press.
- Hydrogen Science and Engineering: Materials, Processes, Systems and Technology by Stolten, D. and Emonts, B., Wiley-VCH.
- Recent Trends in Fuel Cell Science and Technology by Basu, S., Springer.
- Hydrogen and Fuel Cells: Emerging Technologies and Applications by Sorensen, B., Academic Press.
- Fuel Cell Fundamentals by O'Hayre, R., Cha, S., Colella, W., and Prinz, F., Wiley.
- Fuel Cell Systems Explained by Larminie, J. and Dicks, A., Wiley.
- Hydrogen Energy Systems: Production and Utilization of Hydrogen and Future Aspects by Dincer, I. and Acar, C., Elsevier.
- The Hydrogen Economy by Rifkin, J., Tarcher Publications.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Hydrogen energy	https://youtu.be/nXW1C1sJ8L8?si=ztmUkp-LnQrvvPLc	NPTEL (IIT Guwahati)
Unit-II	Electrolysis of Water for Hydrogen Production	https://youtu.be/689dqOXqfJo?si=JhrzBthH7xeFCo5M	NPTEL (IIT Bombay)
Unit-III	Fuel cells technologies - Part I	https://youtu.be/Eb7pv0oOf_k?si=9nAJYW3MGHCevZB6	NPTEL (IIT Guwahati)
Unit-IV	India's stand on Carbon Neutrality	https://youtu.be/F9OaRcPM-lE?si=cC6m2SWdTfBRkjxp	NPTEL (IIT Madras)

<table>
<tr><td>Course Code</td><td colspan="5">MFTSE310B</td></tr>
<tr><td>Category</td><td colspan="5">Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Smart Grid and Energy Systems</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To familiarize the students with the fundamentals of electrical power systems, smart grid technologies, and their role in modern energy systems.
To develop an understanding of smart grid architecture, components, standards, and challenges associated with conventional and intelligent power networks.
To make the students learn about renewable energy integration, distributed generation, and energy storage technologies in smart grid environments.
To enable students to appreciate the role of smart grids, microgrids, energy storage, electric vehicles, and emerging technologies in achieving sustainable and resilient energy systems.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, terminology, architectures, components, technologies, standards, and applications associated with power systems, smart grids, renewable energy integration, and smart energy systems.	Level 1: Remember
CO2	Explain the principles, functions, and operational characteristics of smart grids, distributed generation systems, renewable energy integration approaches, energy storage technologies, and microgrids.	Level 2: Understand
CO3	Apply the principles of renewable energy integration, demand management, energy storage utilization, communication technologies, and microgrid operation to smart energy systems.	Level 3: Apply
CO4	Analyze the performance, reliability, operational challenges, communication requirements, security aspects, and sustainability impacts of smart grids and future energy systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Power Systems and Smart Grids: Introduction to electrical power systems, Generation, Transmission, Distribution and utilization of electrical energy, Challenges of conventional power grids, Need for smart grids, Evolution of smart grid concept, Characteristics and benefits of smart

grids, Smart grid architecture, Smart grid components, Stakeholders in smart grid systems, Smart grid standards and policies.

Unit II

Renewable Energy Integration in Smart Grids: Solar photovoltaic systems, Wind energy systems, Biomass-based power generation, Distributed generation concepts, Grid integration challenges of renewable energy systems, Intermittency and variability of renewable resources, Forecasting techniques, Power quality issues, Grid codes and standards for renewable energy integration, Virtual power plants.

Unit-III

Smart Metering and Demand Side Management: Advanced Metering Infrastructure (AMI), Smart meters and their functions, Real-time monitoring and control, Demand response programs, Demand-side management techniques, Load forecasting, Peak load management, Energy efficiency measures, Consumer participation in smart grids, Smart homes and smart buildings.

Energy Storage Systems and Microgrids: Role of energy storage in smart grids, Battery energy storage systems, Lithium-ion batteries, Flow batteries, Supercapacitors, Hydrogen energy storage, Pumped hydro storage, Microgrid concepts and architecture, Grid-connected and islanded operation, Microgrid control strategies, Resilience and reliability enhancement.

Unit-IV

Communication Technologies and Future Smart Energy Systems: Communication requirements in smart grids, Wired and wireless communication technologies, Internet of Things (IoT) in energy systems, Supervisory control and data acquisition (SCADA), Cyber security issues in smart grids, Artificial intelligence and machine learning applications in energy management, Electric vehicle integration, Smart cities and future energy systems.

Suggested Readings:

- Smart Grids: Infrastructure, Technology and Solutions by Stuart Borlase, CRC Press.
- Smart Grid: Technology and Applications by Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu and Akihiko Yokoyama, Wiley.
- Design of Smart Power Grid Renewable Energy Systems by Ali Keyhani, Wiley-IEEE Press.
- The Smart Grid: Enabling Energy Efficiency and Demand Response by Clark W. Gellings, CRC Press.
- Smart Grid: Fundamentals of Design and Analysis by James Momoh, Wiley-IEEE Press.
- Microgrids and Active Distribution Networks by S. Chowdhury and S. P. Chowdhury, IET Publications.
- Smart Grid: Integrating Renewable, Distributed and Efficient Energy by Fereidoon P. Sioshansi, Academic Press.
- Energy Technology by O.P. Gupta, Khanna Publishing House.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Introduction to electrical power systems	https://youtu.be/3TR_DS_7z2w?si=OTlyX7s6K2qEHA6D	NPTEL (IIT Kharagpur)
Unit-II	Biomass-based power generation	https://youtu.be/KSN9whMllAk?si=UxlMglteO9ZvAk_7	NPTEL (IIT Guwahati)
Unit-III	Lithium-ion batteries	https://youtu.be/no4vRKvKxcU?si=h0oXn6GVej9sDL84	NPTEL (IIT Kharagpur)
Unit-IV	Internet of Things (IoT) in energy systems	https://youtu.be/WUYAjxnwjU4?si=p70L9m51s9iHGUPq	NPTEL (IIT Kharagpur)

<table>
<tr><td>Course Code</td><td colspan="5">MFTSE312B</td></tr>
<tr><td>Category</td><td colspan="5">Electives Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Solar Energy Technologies and System Design</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To familiarize the students with the fundamentals of solar energy, solar radiation principles, and solar resource assessment techniques.
To develop an understanding of photovoltaic and solar thermal energy conversion technologies and their applications.
To make the students learn about solar photovoltaic components, performance characteristics, and factors influencing the efficiency of solar energy systems.
To enable students to appreciate the role of solar energy technologies and emerging innovations in achieving sustainable and clean energy development.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, terminology, principles, technologies, components, and applications associated with solar energy systems and solar energy conversion processes.	Level 1: Remember
CO2	Explain the principles of solar radiation, photovoltaic energy conversion, solar thermal energy conversion, system components, and factors affecting solar energy system performance.	Level 2: Understand
CO3	Apply the principles of solar energy conversion, system sizing, component selection, and performance assessment to photovoltaic and solar thermal energy systems.	Level 3: Apply
CO4	Analyze the technical performance, energy yield, economic feasibility, reliability, environmental benefits, and sustainability aspects of solar energy systems for effective decision-making.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Solar Energy: Solar energy and its importance, Structure of the sun, Solar spectrum, Solar constant, Extraterrestrial and terrestrial solar radiation, Solar radiation measurement, Beam, Diffuse and global radiation, Solar angles, Sun-path diagrams, Solar energy potential assessment, Solar radiation data for India.

Unit-II

Solar Photovoltaic Technologies: Principles of photovoltaic energy conversion, Semiconductor fundamentals, Photovoltaic effect, Solar cell materials, Crystalline silicon, Thin-film and emerging solar cells, Solar cell characteristics, I–V and P–V curves, Efficiency and performance parameters, Photovoltaic modules and arrays, Factors affecting PV performance.

Unit-III

Solar Thermal Energy Technologies: Fundamentals of solar thermal energy conversion, Flat plate collectors, Evacuated tube collectors, Concentrating solar collectors, Solar water heating systems, Solar air heaters, Solar cookers, Solar dryers, Concentrated Solar Power (CSP) systems, Thermal energy storage for solar applications.

Unit-IV

Solar Energy System Design and Applications: Load assessment and energy demand estimation, Sizing of photovoltaic systems, Battery sizing and selection, Inverter selection, Stand-alone, Grid-connected and hybrid solar systems, System layout and installation considerations, Solar pumping systems, Rooftop solar systems, Building-Integrated, Photovoltaics(BIPV).

Performance Evaluation, Economics and Emerging Technologies: Performance analysis of solar energy systems, Energy yield assessment, Losses in solar systems, Reliability and maintenance, Economic evaluation of solar projects, Life cycle cost analysis, Payback period, Levelized Cost of Energy (LCOE),Environmental benefits, Floating solar PV, Agrivoltaics, Bifacial modules, Smart solar energy systems.

Suggested Readings:

- Solar Energy: Principles of Thermal Collection and Storage by S. P. Sukhatme and J. K. Nayak, McGraw Hill.
- Solar Photovoltaics: Fundamentals, Technologies and Applications by C. S. Solanki, PHI Learning.
- Solar Energy: Fundamentals and Applications by H. P. Garg and S. Prakash, McGraw Hill.
- Fundamentals of Renewable Energy Sources by G. N. Tiwari and M. K. Ghosal, Narosa Publishing House.
- Renewable Energy Resources by John Twidell and Tony Weir, Routledge.
- Photovoltaic Systems Engineering by Roger A. Messenger and Jerry Ventre, CRC Press.
- Renewable and Efficient Electric Power Systems by Gilbert M. Masters, Wiley.
- Energy Technology by O. P. Gupta, Khanna Publishing House.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Solar angles	https://youtu.be/zHYjuF48Tlc?si=O1376PmmyNJb3rWJ	NPTEL (IIT Guwahati)
Unit-II	Semiconductor fundamentals	https://youtu.be/q7VIITSysMs?si=Ag-GYQs6-wqHFx4S	NPTEL (IIT Guwahati)
Unit-III	Concentrated Solar Power (CSP) systems	https://youtu.be/boATMyQowDQ?si=XeoNUh3tDdgEihpn	NPTEL (IIT Madras)
Unit-IV	Photovoltaics	https://youtu.be/UVN1-SMyEDs?si=Et5p7Bt2_5q-4FC8	NPTEL (IIT Kanpur)

<table>
<tr><td>Course Code</td><td colspan="5">MFTSE401B</td></tr>
<tr><td>Category</td><td colspan="5">Electives Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Sustainable Energy Policy</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VII</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To familiarize the students with the fundamental concepts of sustainable energy policy, energy governance and their role in sustainable development.
To develop an understanding of energy security, energy access, environmental protection and policy frameworks supporting sustainable energy systems.
To make the students learn about renewable energy policies, energy efficiency regulations and policy instruments that promote sustainable energy adoption.
To enable students to appreciate the role of policy interventions, regulatory mechanisms and institutional frameworks in achieving sustainable and low-carbon energy futures.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">75 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, terminology, principles, policy instruments, regulatory frameworks and governance mechanisms associated with sustainable energy systems and energy policy.	Level 1: Remember
CO2	Explain the relationships among sustainable development, energy security, renewable energy promotion, energy efficiency, climate change mitigation,and energy governance frameworks.	Level 2: Understand
CO3	Apply policy principles, regulatory approaches, sustainability concepts and energy governance frameworks to issues related to renewable energy deployment, energy efficiency, and climate action.	Level 3: Apply
CO4	Analyze energy policies, climate regulations, governance structures, market mechanisms and emerging energy trends to support informed decision-making in sustainable energy planning and management.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Sustainable Energy Policy: Energy and sustainable development, Principles of sustainability, Energy security, Energy access and environmental protection, Role of government in energy planning, Policy-making process, Stakeholders in energy policy, Energy governance, Sustainable Development Goals (SDGs) and energy sector

Unit-II

Renewable Energy and Energy Efficiency Policies: Policies promoting renewable energy technologies, Renewable Purchase Obligations (RPOs),Feed-in tariffs, Renewable Energy Certificates (RECs),Net metering, rooftop solar policies, Energy conservation policies, Energy efficiency standards and labeling, Demand-side management programs, Energy efficiency regulations.

Unit-III

Solar Thermal Energy Technologies: Fundamentals of solar thermal energy conversion, Flat plate collectors, Evacuated tube collectors, Concentrating solar collectors, Solar water heating systems, Solar air heaters, Solar cookers, Solar dryers, Concentrated Solar Power (CSP) systems, Thermal energy storage for solar applications.

Unit-IV

Climate Change and Sustainable Energy Regulations: Energy and climate change linkages, Greenhouse gas emissions from the energy sector, International climate agreements including United Nations Framework Convention on Climate Change, Kyoto Protocol and Paris Agreement, Carbon pricing mechanisms, Carbon taxes, Emissions trading systems, Nationally Determined Contributions (NDCs), India's climate commitments and energy transition strategies.

Emerging Trends and Future Energy Policy Challenges: Energy transition pathways, Smart grids, Distributed energy resources, Electric mobility policies, Hydrogen economy and green hydrogen initiatives, Energy justice and equity, Financing sustainable energy projects, Public-private partnerships, Policy challenges in renewable energy integration, Future outlook of sustainable energy governance.

Suggested Readings:

- Energy Economics: Concepts, Issues, Markets and Governance by Subhes C. Bhattacharyya, Springer.
- The Governance of Energy Megaprojects by Benjamin K. Sovacool, Edward Elgar Publishing.
- Renewable Energy and Sustainable Futures by D. Elliott, Palgrave Macmillan.
- Energy Technology by O. P. Gupta, Khanna Publishing House.
- Sustainable Energy Policy, CRC Press.
- Energy Policy, Routledge.
- Handbook of Energy Policy, Edward Elgar Publishing.
- International Energy Agency reports and policy outlook publications.
- Publications of the Ministry of New and Renewable Energy.

Useful Video Links

Unit No.	Topic	Link	Source
Unit-I	Principles of sustainability	https://www.youtube.com/watch?v=EGVQmNAoIFY	NPTEL (IIT Kharagpur)
Unit-III	Fundamentals of solar thermal energy conversion	https://www.youtube.com/watch?v=mpHZWYpKDJg	NPTEL (IIT Kharagpur)
Unit-IV	Kyoto Protocol	https://youtu.be/97r4704L84s?si=RrgODYsigBksWe5r	NPTEL (IIT Bengaluru)

Annexure AC/5.32

DEPARTMENT OF MECHANICAL ENGINEERING

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

An Autonomous Institute | NAAC 'A' Grade Institute | Affiliated to MDU, Rohtak

Minutes of the 4th Meeting of the Board of Studies of Mechanical Engineering Department

The 4th Meeting of the Board of Studies of Mechanical Engineering Department was held on 16th June, 2026 at 11:00 A.M in the office of Mechanical Engineering Department.

The following members were present for the BoS meeting:

SN	Name of the Member	Designation/Affiliation	Category
1	Mr. Vivek	Head of Mechanical Engineering Department, GITAM, Kablana	Chairperson, Board of Studies
2	Dr. Deepak Chhabra	Professor, UIET, MDU Rohtak	University Nominee
3	Dr. Vasdev Malhotra	Professor, J.C Bose UST, YMCA Faridabad	Subject Expert (Outside the Parent University)
4	Dr. V. N. Mathur	Professor, MAIT Rohini	Subject Expert (Outside the Parent University)
5	Dr. Aman Aggarwal	Professor, GITAM Kablana	Internal Member
6	Dr. Jitender Kumar	Professor, GITAM Kablana	Internal Member
7	Dr. Hari Parshad	Professor, GITAM Kablana	Internal Member
8	Dr. Sunil Kadiyan	Professor, GITAM Kablana	Internal Member
9	Dr. Vishant Kumar	Professor, GITAM Kablana	Internal Member
10	Dr. Devender Singh Punia	Assistant Professor, GITAM Kablana	Internal Member
11	Mr. Parvesh	Assistant Professor, GITAM Kablana	Internal Member
12	Mr. Bhoop Singh	Assistant Professor, GITAM Kablana	Internal Member
13	Dr. Balraj Hooda	Assistant Professor, GITAM Kablana	Internal Member
14	Mr. Manmohan	Assistant Professor, GITAM Kablana	Internal Member
15	Mr. Chirag Verma	Assistant Professor, GITAM Kablana	Internal Member
16	Mr. Vikas Goel	Assistant Professor, GITAM Kablana	Internal Member
17	Mr. Nikhil Sikka	Assistant Professor, GITAM Kablana	Internal Member
18	Mr. Vishnu	Assistant Professor, GITAM Kablana	Internal Member
19	Mr. Manoj Kumar	Assistant Professor, GITAM Kablana	Internal Member

At the outset, the Chairperson welcomed all the members present and thanked them for attending the meeting. The agenda items, as circulated prior to the meeting, were taken up for discussion.

Item No. 4.1 Confirmation of the minutes of the 3rd meeting of the Board of Studies of Mechanical Engineering Department held on 27.12.2025.

To confirm the minutes of the 3rd meeting of the Board of Studies of Mechanical Engineering Department held on 27.12.2025, as circulated earlier **(Annexure 4.1 Pages 1-3).**

GANGA INSTITUTE OF TECHNOLOGY & MANAGEMENT, KABLANA ★ HOD ME

RESOLVED THAT THE MINUTES OF THE 3RD MEETING OF THE BOARD OF STUDIES OF MECHANICAL ENGINEERING DEPARTMENT HELD ON 27.12.2025, AS CIRCULATED EARLIER (ANNEXURE 4.1, PAGES 1-3) BE CONFIRMED.

Item No. 4.2 Follow-up action report on the decisions taken in the 3rd meeting of the Board of Studies of Mechanical Engineering Department held on 27.12.2025.

To note the follow-up action on the decisions taken in the 3rd meeting of the Board of Studies of Mechanical Engineering Department held on 27.12.2025 **(Annexure 4.2 Page No. 4-5).**

RESOLVED THAT THE FOLLOW-UP ACTION ON THE DECISIONS TAKEN IN THE 3RD MEETING OF BOARD OF STUDIES OF MECHANICAL ENGINEERING DEPARTMENT HELD ON 27.12.2025, AS CIRCULATED EARLIER (ANNEXURE 4.2, PAGES 4-5) BE NOTED.

Item No. 4.3 Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech. Mechanical Engineering 3rd year *w.e.f.* the Academic Session 2026–27.

The proposed Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech. Mechanical Engineering 3rd year *w.e.f.* the Academic Session 2026–27, placed before the Board as **Annexure 4.3, Pages 6–64**.

The Board of Studies may consider and approve the proposed Scheme of Studies & Examinations and Syllabi (A-Scheme) of B.Tech. Mechanical Engineering 3rd year.

RESOLVED THAT THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (A-SCHEME) OF B.TECH. MECHANICAL ENGINEERING 3RD YEAR *w.e.f.* THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.3, PAGES 6-64) BE APPROVED.

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR CONSIDERATION AND APPROVAL.

Item No. 4.4 Scheme of Studies & Examinations and Syllabi (B-Scheme) of B.Tech. Mechanical Engineering 2nd year *w.e.f.* the Academic Session 2026–27.

The Institute implemented NEP-2020 *w.e.f.* the Academic Session 2025-26 (For 1st Year). The Scheme of Studies & Examinations and Syllabi have been proposed accordingly for B.Tech. Mechanical Engineering 2nd year **(Annexure 4.4 Pages 65-119).** The revised scheme shall be designated as the B-Scheme in accordance with NEP-2020.

The Board of Studies may consider and approve the Scheme of Studies & Examinations and Syllabi (B-Scheme) for B.Tech. Mechanical Engineering 2nd year.

GANGA INSTITUTE OF TECHNOLOGY & MANAGEMENT, KABLANA
HOD/ME

RESOLVED THAT THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (B-SCHEME) OF B.TECH. MECHANICAL ENGINEERING 2ND YEAR *w.e.f.* THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.4, PAGES 65-119) BE APPROVED.

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR CONSIDERATION AND APPROVAL.

Item No. 4.5 Scheme of Studies & Examinations and Syllabi (B-Scheme) for Minor Degree/Honours (Hons.)/Specialization in "Robotics" *w.e.f.* the Academic Session 2026–27.

Name of the Minor Degree/Honours (Hons.)/Specialization	B. Tech Program whose students are eligible to opt for Minor Degree	B. Tech Program whose students are eligible to opt for Honours (Hons.)/Specialization
Robotics	All B.Tech. Programmes except Mechanical Engineering, Electrical Engineering and Electronics & Communication Engineering	Mechanical Engineering, Electrical Engineering and Electronics & Communication Engineering

The Board of Studies may consider and approve the Scheme of Studies & Examinations and Syllabi (B-Scheme) for Minor Degree/Honours (Hons.)/Specialization in "Robotics" **Annexure 4.5, Pages 120–136.**

RESOLVED THAT THE SCHEME OF STUDIES & EXAMINATIONS AND SYLLABI (B-SCHEME) FOR MINOR DEGREE/HONOURS (HONS.)/SPECIALIZATION IN "ROBOTICS" *w.e.f.* THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.5, PAGES 120-136) BE APPROVED.

FURTHER RESOLVED THAT THE APPROVED SCHEME OF STUDIES AND EXAMINATIONS AND SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR CONSIDERATION AND APPROVAL.

Item No. 4.6 Syllabi of Open Elective Courses offered by Mechanical Engineering Department for B.Tech. 3rd Year (A-Scheme) *w.e.f.* the Academic Session 2026–27.

To approve the syllabi of the Open Elective Courses offered by Mechanical Engineering Department for B.Tech. 3rd Year (A-Scheme) **(Annexure 4.6 Pages 137-140)** *w.e.f.* the Academic Session 2026–27.

GANGA INSTITUTE OF TECHNOLOGY & MANAGEMENT, KABLANA
HOD/ME

Sr. No.	Course Code	Course Title	Offered by	Departments Eligible to Choose the Course
1	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
2	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
3	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

RESOLVED THAT THE SYLLABI OF OPEN ELECTIVE COURSES OFFERED BY MECHANICAL ENGINEERING DEPARTMENT FOR B.TECH. 3RD YEAR (A-SCHEME) *W.E.F.* THE ACADEMIC SESSION 2026–27 (ANNEXURE 4.6, PAGES 137-140) BE APPROVED.

FURTHER RESOLVED THAT THE APPROVED SYLLABI AS MENTIONED ABOVE BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR CONSIDERATION AND APPROVAL.

Item No. 4.7 Panel of Examiners for Theory and Practical Examinations of B.Tech. and M.Tech. programmes for Academic Session 2026-27.

The BOS, in its meeting held on 27.12.2025 vide its Reso. No 9, approved the Panel of Examiners for Theory and Practical Examinations of B.Tech. and M. Tech. Programs **(Annexure 4.7 Pages 141-143)**. The Board of Studies may now review the existing panel to ensure the inclusion of additional eligible and qualified examiners, if required, to further strengthen the evaluation process for the upcoming academic year.

RESOLVED THAT THE PANEL OF EXAMINERS FOR THEORY AND PRACTICAL EXAMINATIONS OF B.TECH. AND M.TECH. PROGRAMMES FOR THE ACADEMIC SESSION 2026-27 (ANNEXURE 4.7, PAGES 141-143) BE APPROVED.

FURTHER RESOLVED THAT THE SAME BE FORWARDED TO THE CONTROLLER OF EXAMINATIONS OF THE INSTITUTE FOR NECESSARY ACTION AND RECORD.

Item No. 4.8 Any other Item with the permission of Chair.

There being no other item for discussion, the meeting concluded with a vote of thanks to the Chair.

Mr. Vivek
Chairperson, Board of Studies
Department of Mechanical Engineering

Annexure AC/ 5.33

~~Annexure 4.3~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations For

Bachelor of Technology (Mechanical Engineering)

Effective from

Academic Session 2026-27 (3rd Year)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Basic Science Courses	BSC
2	Engineering Science Courses	ESC
3	Professional Core Courses	PCC
4	Professional Elective Courses	PEC
5	Humanities and Social Sciences including Management Courses	HSMC
6	Multidisciplinary Open Electives Courses	OEC
7	Value Added Courses	VAT
8	Project	PR
9	Practical Training	PT
10	Seminar	SM
11	Internship	INT
12	Mandatory Non-Credit Courses (Audit Course)	MC
13	Laboratory Courses	LC

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA JHAJJAR (HR.)

Scheme of Studies and Examinations

B. Tech (Mechanical Engineering) – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Course	PCC-ME-301A	Solid Mechanics	3	1	0	4	4	40	60		100	3
2	Professional Core Course	PCC-ME-303A	Dynamics of Machines	3	1	0	4	4	40	60		100	3
3	Professional Core Course	PCC-ME-305A	Fluid Machines	3	0	0	3	3	40	60		100	3
4	Professional Core Course	PCC-ME-307A	Manufacturing Technology-II	3	0	0	3	3	40	60		100	3
5	Professional Elective Course	----------	**Refer Table 2**	3	0	0	3	3	40	60		100	3
6	Humanity Science & Management Courses	HSMC-02A	Economics for Engineers	3	0	0	3	3	40	60		100	3
7	Professional Core Course	LC-ME-319A	Dynamics of Machines Lab	0	0	2	2	1	25		25	50	-
8	Professional Core Course	LC-ME-321A	Fluid Machines Lab	0	0	2	2	1	25		25	50	-
9	Professional Core Course	LC-ME-323A	Manufacturing Technology-II Lab	0	0	2	2	1	25		25	50	-
10	Practical Training	PT-ME-325A	Practical Training -I	0	0	2	2	1	50			50	-
Total Credits								**24**				**800**	

Note: Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

Table 2: Professional Elective Courses-II

Sr. No.	Course Code	Course Name
1	PEC-ME-309A	Solar Energy Engineering
2	PEC-ME-311A	Mechanical Vibrations
3	PEC-ME-313A	Material Characterization Methods
4	PEC-ME-315A	Metrology and Quality Control
5	PEC-ME-317A	Operations Research
6		Any one of the MOOCs not studied earlier and of equal credits (3)

Note: Students have to select any one course from the above list, provided that the course has not been studied earlier.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

B. Tech (Mechanical Engineering) – 6th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Course	PCC-ME-302A	Design of Machine Elements-I	3	1	0	4	4	40	60		100	3
2	Professional Core Course	PCC-ME-304A	Heat Transfer	3	1	0	4	4	40	60		100	3
3	Professional Core Course	PCC-ME-306A	Internal Combustion Engine and Gas Turbine	3	0	0	3	3	40	60		100	3
4	Professional Core Course	PCC-ME-308A	Mechanical Measurements	3	0	0	3	3	40	60		100	3
5	Professional Elective Course	----------	**Refer Table 3**	3	0	0	3	3	40	60		100	3
6	Open Elective Course	----------	**Refer Table 4**	3	0	0	3	3	40	60		100	3
7	Professional Core Course	LC-ME-320A	Heat Transfer Lab	0	0	2	2	1	25		25	50	-
8	Professional Core Course	LC-ME-322A	Mechanical Measurement Lab	0	0	2	2	1	25		25	50	-
9	Professional Core Course	LC-ME-324A	Internal Combustion Engine Lab	0	0	2	2	1	25		25	50	-
10	Seminar	SM-ME-326A	Seminar	0	0	2	2	1	50			50	-
11	Mandatory Non-Credit Course	MC-301A	Essence of Indian Traditional Knowledge	2	0	0	2		40	60			3
Total Credits								**24**				**800**	

Note: At the end of 6th semester, each student has to undergo Practical Training of 4/6 weeks in the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and its evaluation shall be carried out in the 7th Semester. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

Table 3: Professional Elective Courses – III

Sr. No.	Course Code	Course Name
1	PEC-ME-310A	Gas Dynamics and Jet Propulsion
2	PEC-ME-312A	Industrial Robotics
3	PEC-ME-314A	Quality Engineering
4	PEC-ME-316A	Smart Materials
5	PEC-ME-318A	Plant Maintenance Engineering
6		Any one of the MOOCs not studied earlier and of equal credits (3)

Note: Students have to select any one course from the above list, provided that the course has not been studied earlier.

Table 4: Open Elective Courses – I

Sr. No.	Course Code	Course Title	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

Note: Students have to select any one course from the above list, provided that the course has not been studied earlier.

Course Code	**PCC-ME-301A**				
Category	Professional Core Courses				
Course Title	**Solid Mechanics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts and properties of materials. • To know the relationship between force, stress, and displacement. • To compute the stresses and deflections in structural and machine elements. • To study the behavior and response of a body under different loading conditions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts and properties of materials.	L1: Remember
CO2	Explain the theorems and governing equations of solid mechanics.	L2: Understand
CO3	Apply appropriate methods to solve numerical problems related to structural elements.	L3: Apply
CO4	Analyze the behaviour and response of a body under different loading conditions.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Strain Energy & Resilience**: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's theorem & Maxwell's reciprocal theorem, Numerical. **Theories of Elastic Failure**: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numerical.
Unit-II	**Unsymmetrical Bending**: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis Numerical. **Springs**: Stresses in close coiled and open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numerical.
Unit-III	**Thin Pressure Vessels**: Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire would cylinder, Numerical. **Thick Pressure Vessels**: Derivation of Lame's equations, Radial & Hoop Stresses in compound spherical shells subjected to internal fluid pressure only, wire wound cylinders, hub shrunk on solid shaft, Numerical.

Unit-IV	**Bending of Curved Bars**: Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem stresses in simple chain link, deflection of simple chain links, Problems.

Suggested Readings:

1. Strength of Materials – G.H. Ryder; Macmillan, India.
2. Strength of Materials – U.C. JINDAL; Pearson India
3. Strength of Materials – Sadhu Singh; Khanna Publishers
4. Book of Solid Mechanics – Kazmi; Tata Mc Graw Hill
5. Strength of Materials – D.S. Bedi; S. Chand & Co. Ltd.

Web References:

1. https://nptel.ac.in/courses/112102284
2. https://www.youtube.com/playlist?list=PLwdnzlV3ogoXCA3yBWCfaOqIQWLKLkePI
3. https://youtu.be/TsgxnU9KE5g?si=obzrbAR_ulSL92mf
4. https://youtu.be/P8dnia5x5dU?si=IBG8E0LbEC5WRl09

Course Code	**PCC-ME-303A**				
Category	Professional Core Courses				
Course Title	**Dynamics of Machines**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To introduce the student with fundamental knowledge of the dynamics of machines. • To provide fundamental knowledge of the dynamics of machines to solve problems of transmissibility of forces, isolation of systems, and vibrations. • To develop knowledge of analytical and graphical methods for calculating the balancing of rotary and reciprocating masses. • To learn the special purpose mechanisms used in designing a machine.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the concepts and basic terminologies of the dynamics of Machines.	L1: Remember
CO2	Explain the principles of force analysis, balancing, governors, gyroscopic effects, and dynamic behavior of machine systems.	L2: Understand
CO3	Apply the principles of dynamics of machines to solve problems related to forces, motion, and performance of mechanical systems.	L3: Apply
CO4	Analyze the dynamic behaviour and performance characteristics of machine systems.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Static and Dynamic Force Analysis**: Static and dynamic force analysis of planer mechanisms, including inertia and frictional forces of planer mechanisms, turning moment diagrams and flywheel applications. **Dynamics of Reciprocating Engines**: engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces.
Unit-II	**Balancing of Rotating Components**: Static and dynamic balancing, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing. **Balancing of Reciprocating Parts**: Balancing of single cylinder engine, balancing of multi cylinder, inline, radial and V type engines, firing order.

Unit-III	**Governors**: Introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors. Introduction to electronic governors and modern speed control systems. **Dynamometers**: Types of dynamometers, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer. Applications in engine testing and performance analysis.
Unit-IV	**Gyroscope**: Gyroscopes, gyroscopic forces and couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two-wheel vehicles moving on curved paths. **Rotor Dynamics:** Introduction to rotor dynamics, critical speed of shafts, whirling of shafts, balancing of flexible rotors and applications in turbines and rotating machinery.

Suggested Readings:

1. Theory of Machines- R S Khurmi & J K Gupta; S Chand.
2. Theory and Machines- S.S. Rattan; Tata McGraw-Hill.
3. Theory of Mechanisms and Machines- Amitabha Ghosh and Ashok Kumar Malik, East-West Press.
4. Theory of Machines and Mechanisms- Joseph Edward Shigley, John Joseph Uicker; MGH, New York.
5. Mechanism and Machine Theory- J.S. Rao and R.V. Dukkipati, Second Edition, New Age International.
6. Theory of Machines- Beven, Pearson Indian Education Service Pvt. Ltd. India.

Web References:

1. https://nptel.ac.in/courses/112104114
2. https://nptel.ac.in/courses/112101096
3. https://youtu.be/p075LPq3Eas?si=fwUbiqsgFJznSDxP

Course Code	**PCC-ME-305A**				
Category	Professional Core Courses				
Course Title	**Fluid Machines**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce to working principles and construction details of hydraulic machines • To learn governing equations and hydraulic principles to solve the hydraulic engineering problems. • To enable students to analyze the performance of hydraulic turbines. • To impart knowledge of design aspects of impulse and reaction turbines.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define & list various components of fluid machines.	L1: Remember
CO2	Describe construction and working principles of hydraulic machines & systems.	L2: Understand
CO3	Apply governing equations and principles to solve fluid machines problems.	L3: Apply
CO4	Analyze the performance characteristics of various hydraulic machines.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Impact of jets**: Impulse–momentum principle, jet impingement on stationary and moving plates and vanes, jet propulsion of ships, applications in hydraulic systems. Numerical problems. **Impulse turbines**: Classification of turbines, Pelton wheel construction and operation, governing mechanisms, work done, effective head, available head, efficiency, design parameters, performance characteristics and applications in hydroelectric power plants, Problems.
Unit-II	**Francis turbines**: Construction, operation, governing mechanism, work done, design parameters, performance characteristics and applications, Problems. **Propeller and Kaplan turbines**: Construction, operation, governing of reaction turbines, draft tubes and their functions, performance characteristics, governing of reaction turbine, introduction to modern turbines such as Deriaz, Bulb and Tubular turbines, Problems.
Unit-III	**Dimensional Analysis and Model Similitude**: Dimensional homogeneity, Rayleigh's method, Buckingham π theorem, model studies and similitude, dimensionless numbers and their significance. Unit quantities. Numerical problems. **Centrifugal pumps**: Classification, velocity triangles and work done, manometric efficiency, vane shape, head capacity relationship and pump losses, pressure rise in impeller, minimum starting speed, design considerations, multistage pumps, cavitation, performance characteristics and applications in industrial systems, Problems.

Unit-IV	**Reciprocating Pumps**: Construction and operational details, discharge coefficient, volumetric efficiency and slip, work and power input, indicator diagrams, air vessels and their utility, rate of flow into or from the air vessel, maximum speed of the rotating crank, characteristic curves, centrifugal vs reciprocating pumps, brief introduction to screw, gear, vane and radial piston pumps, Problems. **Hydraulic systems**: Function, construction and operation of Hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift and hydraulic press, Fluid coupling and torque converter, Hydraulic ram, Problems.

Suggested Readings:

1. Fluid Mechanics and Hydraulic Machines – S S Rattan; Khanna Publishers.
2. Introduction to Fluid Mechanics and Fluid Machines – S K Som and G Biswas; Tata McGraw Hill.
3. Fluid Mechanics and Fluid Power Engineering – D S Kumar; S K Kataria and Sons.
4. Hydraulics & Fluid Mechanics – Modi & Seth; Standard Book House, New Delhi.
5. Fluid Mechanics and Hydraulic Machines – R.K. Bansal; Laxmi Publications.

Web References:

1. https://nptel.ac.in/courses/112105206
2. https://nptel.ac.in/courses/112105182
3. https://www.youtube.com/@fluidmachines5626/videos

Course Code	**PCC-ME-307A**				
Category	Professional Core Courses				
Course Title	**Manufacturing Technology-II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To understand the mechanics of metal cutting and tool behavior. • To study conventional, unconventional, and NC machining processes. • To learn jigs, fixtures, CNC programming, and machining systems. • To understand group technology and modern manufacturing concepts.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the basic concepts and terminology used in manufacturing and machining processes.	L1: Remember
CO2	Explain the working principles and operational characteristics of machining and manufacturing systems.	L2: Understand
CO3	Apply machining principles, CNC programming methods, and tooling concepts for manufacturing applications.	L3: Apply
CO4	Analyze machining performance and manufacturing systems for improving productivity and quality.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Mechanism of Metal Cutting**: Mechanics of metal cutting, chip formation, built-up edges, orthogonal and oblique cutting, Merchant cutting force circle and shear angle relationship in orthogonal cutting, factors affecting tool forces, cutting speed, feed and depth of cut, surface finish. temperature distribution at tool chip interface. Numerical. **Cutting Tool Materials & Cutting Fluids**: Characteristics of tool materials, various types of cutting tool materials, coated tools, cutting tool selection, types of tool wear, tool life, factors governing tool life, purpose and types of cutting fluids, basic actions of cutting fluids, effect of cutting fluid on tool life, selections of cutting fluid.
Unit-II	**Unconventional Machining Processes**: Abrasive jet machining, ultrasonic machining, electrochemical machining and grinding, electric discharge machining, electron beam machining, laser beam machining: principles, plasma arc machining, ion beam machining, water jet machining, hot machining, chemical machining, process parameters, advantages, limitations and applications. **Jigs & Fixtures**: Introduction, location and location devices, clamping and clamping devises, drill jigs, milling fixtures and tooling applications.

Unit-III	**Numerical Control of Machine Tools:** Introduction, Numerical Control & its growth, NC Machines tools, Axes of NC Machines, Classification of NC System, CNC, DNC and Machining Centre. Machine Control unit, NC tools & Tool changer. **Manual Part Programming**: Coordinate systems, feed, speed, tool function, preparation & miscellaneous functions, G and M codes for turning and milling operations.
Unit-IV	**Group Technology:** Definition and concept, component classification and coding systems, Group Technology layout, working of group technology, stages for adopting group technology, advantages of Group Technology. **Modern Manufacturing System**: Process planning, computer aided process planning (CAPP), lean manufacturing and quality concepts in manufacturing systems.

Suggested Readings

1. Manufacturing Technology Vol. - 2, P.N. Rao, T.M.H, New Delhi
2. Computer Aided Manufacturing: S Kumar & B Kant Khan, Satya Prakashan, New Delhi.
3. Principles of Machine Tools G.C. Sen & A. Bhattacharya, Tata McGraw Hill, New Delhi
4. Manufacturing Engineering & Technology- Serope Kalpakian, Pearson.
5. Modern Machining Processes- P.C. Pandey & H.S. Shan, T.M.H. Company, New Delhi
6. A course in Workshop Technology Vol-2 (Machine Tools)- B.S. Raghuwanshi, Dhanpat Rai & Co.

Web Reference:

1. https://nptel.ac.in/courses/112104290
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_me05
3. https://www.youtube.com/watch?v=7yzvno4AvKw
4. https://nptel.ac.in/courses/112105211
5. https://onlinecourses.nptel.ac.in/e-learning/preview/noc19_me46
6. http://www.digimat.in/nptel/courses/video/112104289/L28.html
7. https://nptel.ac.in/courses/112107078

Course Code	**PEC-ME-309A**				
Category	Professional Core Courses				
Course Title	**Solar Energy Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are • To learn the basic principles of solar energy and solar radiation. • To study solar thermal and solar photovoltaic systems and their applications. • To emphasize on the performance of solar heating, cooling, and power generation systems. • To know the environmental and economic benefits of solar energy systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the basic concepts of solar energy systems.	L1: Remember
CO2	Explain the fundamentals, principles and components of solar energy systems.	L2: Understand
CO3	Apply the principles of solar energy for energy conversion and utilization.	L3: Apply
CO4	Analyze the performance, environmental impact, and economic aspects of solar energy systems.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Solar Radiation:** Introduction to solar energy, solar system, sun-earth relationship, solar angles, solar time, solar radiation geometry, solar constant, estimation of beam and diffuse solar radiation, measurement of solar radiation using pyrheliometers and other devices. **Effect of Solar radiation upon structures:** Solar radiation properties of surfaces, absorptivity, reflectivity and transmissivity, steady and periodic heat transfer through walls and roofs, shading devices and solar heat gain.
Unit-II	**Solar Thermal Collectors:** Flat plate collectors, concentrating collectors, comparative study, materials and construction, selective coatings, collector efficiency, heliostats. **Heating Applications of Solar Energy:** Solar water heating systems, solar air heaters, thermal energy storage, solar ponds, solar cookers, solar drying of grains, solar pumping systems and industrial process heating.

Unit-III	**Cooling Applications of Solar Systems:** Solar refrigeration principles, Continuous and intermittent vapor absorption refrigeration systems, absorbent–refrigerant combinations, adsorption refrigeration systems, coefficient of performance (COP). **Passive Solar Systems:** Passive cooling and heating techniques, natural ventilation, evaporative cooling, thermal insulation, thermal mass, Trombe wall, passive solar building concepts and energy-efficient buildings
Unit-IV	**Solar Electric Conversion Systems:** Photovoltaic effect, solar cells and modules, types of solar cells, characteristics of PV systems, batteries, charge controllers, inverters, standalone and grid-connected PV systems, solar lighting systems. **Environmental Aspects:** Environmental impacts of conventional energy systems, greenhouse effect, global warming, ozone layer depletion, carbon reduction through renewable energy, economic analysis of solar energy systems, renewable energy policies and international initiatives.

Suggested Readings:

1. Solar Energy – S P Sukhatme, Tata McGraw Hill
2. Solar Energy Process – Duffie and Bechman, John Wiley
3. Applied Solar Energy – Meinel and Meinel, Addison Wiley
4. Solar Energy: Fundamentals and Applications – R P Garg and Jai Prakash, TMH.

Web Reference:

1. https://nptel.ac.in/courses/115103123
2. https://nptel.ac.in/courses/112104300
3. https://nptel.ac.in/courses/112105050

Course Code	**PEC-ME-311A**				
Category	Professional Elective Courses				
Course Title	**Mechanical Vibrations**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to make the students • To introduce to fundamental concepts of mechanical vibration. • To provide knowledge of vibration control, isolation, balancing, and resonance prevention in machines and structures. • To familiarize students with multi-degree freedom systems, numerical methods, and critical speed analysis of rotating shafts. • To develop the ability to analyze free, damped, and forced vibrations in engineering systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts of mechanical vibrations.	L1: Remember
CO2	Explain the free, damped, forced, and multi-degree freedom vibration systems.	L2: Understand
CO3	Apply vibration principles and numerical methods to determine vibration response and critical speeds of mechanical systems.	L3: Apply
CO4	Analyze vibration behavior, isolation systems, and vibration measurement techniques for engineering applications.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction & Importance of Mechanical Vibration**: Brief history of Mechanical Vibration, Types of Vibration, Simple Harmonic Motion (S.H.M.), Principle of superposition applied to S.H.M., Concept of degree of freedom for different vibrating systems, elements of vibratory system. **Undamped Free Vibrations of Single Degree Freedom Systems**: Derivation of differential equation of motion: the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion: Natural frequency of vibration. Systems involving angular oscillations: the compound pendulum.
Unit-II	**Damped Free Vibration of Single Degree Freedom Systems:** Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration. **Forced Vibration of Single Degree Freedom Systems:** Steady state forced vibration, sources of excitation, impressed harmonic force, resonance, impressed force due to rotating unbalance, base excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping.

Unit-III	**Two-degree Freedom Systems**: Introduction to Multi-Degree of Freedom Systems, Normal Mode Vibrations, Coordinate Coupling, Principal Coordinates, Free Vibrations in Terms of Initial Conditions, Forced Harmonic Vibrations, Vibration Absorber, Centrifugal Vibration Absorber, Vibration Damper. **Multi degrees of Freedom Systems and Numerical Methods:** Introduction, Influence Coefficients, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes, Orthogonality of Normal Modes, Dunkerley's Equation, Method of Matrix Iteration, The Holzer Type Problem, Geared and Branched Systems, Beams.
Unit-IV	**Whirling of shafts**: Critical speeds of shafts – Critical speed of a light shaft having a single disc – without damping and with damping. Critical speed of a shaft having multiple discs – secondary critical speed. **Vibration measurement and Applications**: Piezoelectric transducers and linear variable differential transformer transducer; Vibration pickups: Vibrometer, Accelerometer, Vibration exciters- Mechanical exciters, impact hammer and electrodynamic shaker.

Suggested Readings:

1. Mechanical Vibrations- G. K. Grover, Nem Chand & Bros.
2. Mechanical Vibrations- Dr. V.P. Singh, Dhanpat Rain & Co.
3. Mechanical Vibrations- SS Rao, Pearson
4. Theory and Practice of Mechanical Vibrations- J.S. Rao and K. Gupta, Wiley Eastern Ltd.
5. Theory of Vibration with Applications- William T. William Thomson, CRC Press

Web References:

1. https://nptel.ac.in/courses/112103111
2. https://youtu.be/tJNaPt5aPmg?si=beDymd9LotwGbtGL
3. https://youtu.be/nWM5gg3SkEI?si=Drf3Xxqnngbzsxlc
4. https://www.youtube.com/watch?v=bX_m53Xexvk&list=PLAC668A0566953FB5

Course Code	**PEC-ME-313A**				
Category	Professional Elective Courses				
Course Title	**Material Characterization Methods**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to make the students • To introduce the fundamental concepts of materials characterization techniques. • To understand different structural, chemical, thermal, mechanical, and surface characterization methods. • To study microscopy techniques and specimen preparation methods for material analysis. • To analyze material behavior using mechanical characterization and testing methods.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts, terminology, and characterization techniques used for engineering materials.	L1: Remember
CO2	Explain the principles and mechanical characterization methods for materials.	L2: Understand
CO3	Apply characterization techniques, specimen preparation and testing methods for exploring material properties and behavior.	L3: Apply
CO4	Analyze the structure–property relationship and mechanical performance of materials using characterization techniques.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Materials Characterization:** Introduction to materials characterization and its significance in engineering, Objectives and scope of characterization techniques, Structure–property relationship of materials. **Types of characterization:** Structural, chemical, thermal, mechanical, and surface characterization, their advantages, limitations and applications, Specimen preparation technique.
Unit-II	**Optical Microscopy Techniques: -** Introduction to Microscope and their importance in Material Characterization, Optical microscopy: construction, working principle, magnification, and applications, Metallographic sample preparation and etching. **Electron Microscopy Techniques:** Scanning Electron Microscopy (SEM): principle, instrumentation, and applications, Transmission Electron Microscopy (TEM): working principle and applications, Comparison of optical microscopy, SEM, and TEM.
Unit-III	**Fundamentals of Mechanical Testing:** Introduction to Mechanical Characterization of Materials, Significance and Objectives of Mechanical Testing, Mechanical Properties of Materials. **Tensile & Compression Testing**: Principle, Specimen Standards, Testing Procedure, Stress–Strain Curve, Compression Testing: Principle, Specimen Preparation, Procedure and Applications.

Unit-IV	**Hardness Characterization Methods:** Hardness Testing: Introduction and Importance, Brinell Hardness Test, Rockwell Hardness Test, Vickers Hardness, Principle, Procedure, Advantages and Limitations of Hardness Test. **Impact Characterization Methods:** Izod and Charpy Impact Tests: Principle, Specimen Geometry, Testing Procedure, Comparison between Izod and Charpy impact tests, Applications of impact testing in material selection.

Suggested Readings:

1. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng, Second Edition, Wiley India.
2. Strength Materials Science and Engineering: An Introduction – William D. Callister Jr. & David G. Rethwisch, Wiley India.
3. Materials Characterization Techniques – Sam Zhang, Lin Li & Ashok Kumar, CRC Press.
4. Book Mechanical Metallurgy – George E. Dieter, McGraw Hill Education.

Web References:

1. https://nptel.ac.in/courses/113104004
2. https://nptel.ac.in/courses/102108082
3. https://www.youtube.com/watch?v=0I9uZMR-9x0
4. https://www.youtube.com/watch?v=rAMBnTfXaao

Course Code	**PEC-ME-315A**				
Category	Professional Elective Courses				
Course Title	**Metrology and Quality Control**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to make the students • To introduce basic concepts of metrology and quality control • To understand measurement and inspection techniques. • To apply quality control tools and methods • To study quality performance and process control systems				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of metrology and quality control.	L1: Remember
CO2	Explain the measurement systems, inspection, control charts, inspections and quality concepts.	L2: Understand
CO3	Apply measurement, inspection, and statistical quality control methods for inspection and quality evaluation.	L3: Apply
CO4	Analyzing the quality performance and measurement systems for manufacturing applications.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fundamentals of Metrology and Measurement Systems:** Definition, objectives, and significance of metrology, Standards of measurement: International, primary, secondary, and working standards, Elements of measurement systems, Accuracy, precision, sensitivity, repeatability, reproducibility, and calibration. **Linear and Angular Measurements:** Linear measuring instruments: steel rule, vernier calliper, micro-meter, slip gauges, Angular measurement instruments: bevel protractor, sine bar, angle gauges, Limits, fits, and tolerances, Interchangeability and standardization, Errors in measurement.
Unit-II	**Inspection Planning and Quality Influencing Factors:** Planning of inspection, Selection of product characteristics to be inspected, determination of inspection stages, selection of inspection locations, Types of inspection: remedial inspection, preventive inspection, and operative inspection, Inspection at various stages including incoming inspection, in-process inspection, and final inspection. **Statistical Quality Control:** Basic statistical concepts, empirical distribution and histograms, frequency, mean, mode, standard deviation, normal distribution, binomial and Poisson.
Unit-III	**Quality Concepts and Quality Management:** Definition and dimensions of quality, Quality planning, quality assurance, and quality control, Evolution of quality concepts, Quality costs and quality management principles. **Modern Quality Concepts:** Concept of total quality management (TQM), ISO-9000, concept and its evolution, QC tools, Introduction to Kaizen, 5S.

Unit-IV	**Control charts and sampling:** Introduction to control charts, namely X, R, P and C charts and their applications, Sampling plans, selection of sample size, method of taking samples, frequency of samples. **Quantities Measurement:** Measurement of mechanical quantities such as displacement, vibration, frequency, pressure temperature by electro mechanical transducers of resistance, capacitance & inductance type.

Suggested Readings:

1. Engineering Metrology and Measurements – N.V. Raghavendra and L. Krishnamurthy, Oxford University Press
2. Engineering Metrology – R.K. Jain, Khanna Publishers.
3. Mechanical Measurements and Instrumentation – R.K. Rajput, S. Chand & Co. Ltd.
4. Mechanical Measurements – Beckwith, Marangoni and Lienhard, Pearson Education

Web References:

1. https://nptel.ac.in/courses/112106179
2. http://www.digimat.in/nptel/courses/video/112106179/L08.html
3. https://www.youtube.com/watch?reload=9&v=YHu-6HSP-V4
4. http://www.digimat.in/nptel/courses/video/110104080/L34.html

Course Code	**PEC-ME-317A**				
Category	Professional Elective Courses				
Course Title	**Operations Research**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications. • To provide knowledge of linear programming, transportation, assignment, queuing, simulation, and project management models for industrial applications. • To equip students to use the resources such as capitals, materials, productions, controlling, directing, staffing, and machines more effectively. • To enhance analytical and problem-solving skills for effective resource utilization, planning, scheduling, and decision-making under different environments.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the basic concepts and applications of operations research.	L1: Remember
CO2	Explain the operational research models and optimization techniques used for decision-making and resource management.	L2: Understand
CO3	Apply operations research techniques and algorithms to solve industrial and management problems.	L3: Apply
CO4	Analyze and select the suitable mathematical and techniques for modeling, optimizing and decision-making in industrial systems.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction:** Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods. **Linear Programming (LP)**: Definition and formulation of LPP, graphical, simplex Gauss-Jordan reduction process in simplex methods, BIG-M method. Numerical problems.
Unit-II	**Deterministic Model**: Transportation models-balanced & unbalanced, North-West rule, Vogel's approximation method, least cost method, stepping stone method, MODI methods, degeneracy, assignment, traveling salesman. Numerical problems. **Advanced Topic of LP**: Duality, Primal-Dual relationships & solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

Unit-III	**Waiting Line Models**: Introduction to queuing theory, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems. **Project Line Models**: Network diagrams, events and activities, defects in network construction, PERT & CPM, floats in networks, variance and probability of project completion time, project costs-direct, indirect and total cost, optimal project cost by crashing of network, resource leveling in project, problems.
Unit-IV	**Simulation**: Introduction to simulation, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems. **Decision Theory**: Decision process, Simon's model, decision-making environment- certainty, risk, uncertainty, decision making with utilities, numerical problems.

Suggested Readings:

1. Operations Research - P K Gupta, D S Hira, S Chand Publishers.
2. Operation Research: Theory and Applications - J K Sharma, MacMillan
3. Introduction to O.R - Hiller & Lieberman, Tata McGraw Hill
4. Principles of Operations Research - Wagner, PHI Publications.
5. Operations Research: An Introduction - Hamdy A. Taha, Peason

Web References:

1. https://nptel.ac.in/courses/110106062
2. https://nptel.ac.in/courses/111107128
3. https://nptel.ac.in/courses/112106134
4. https://youtu.be/a2QgdDk4Xjw?si=tcYJEm2CVvLzPvTx

Course Code	**HSMC-02A**				
Category	Humanities and Social Science including Management Courses				
Course Title	**Economics for Engineers**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	3	
Course Objectives	The objectives of this course are • Introduce the basic concepts of economics and their relevance to science, engineering, and national development. • Develop a foundational understanding of microeconomic principles such as demand, supply, production, cost, and market structures. • Equip students with tools to apply economic reasoning to real-world pricing, output, and market decisions. • Familiarize students with macroeconomic elements like the Indian economy, banking system, privatization, and globalization.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe economic concepts, the connection between economics with engineering and technological development, along with economic laws relevant to resource-based decision making in society.	L1: Remember
CO2	Explain economic growth theories and illustrate the role of engineering and technology in supporting economic development.	L2: Understand
CO3	Apply theories of consumption and production to the design and development of engineering products.	L3: Apply
CO4	Analyze market conditions, evaluate cost structures and financial aspects to assess the feasibility of engineering projects.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Definition of Economics:** Various Definitions, Types of Economics, Micro and Macro Economics, Nature of Economic Problem, Production Possibility Curve, Economic Laws and their Nature, Relationship between Science, Engineering, Technology and Economic Development**.** **Demand:** Meaning of Demand, Law of Demand, Elasticity of Demand, Meaning, Factors affecting the Elasticity of Demand, Practical Application and Importance.

Unit-II	**Production:** Meaning of Production and Factors of production, Law of Variable Proportions, Returns to Scale, Internal and External Economies and Diseconomies of Scale, Various concepts of Cost of Production- Fixed Cost, Variable Cost, Money Cost, Real Cost, Accounting Cost, Marginal Cost, Opportunity Cost, Shape of Average Cost, Marginal Cost, Total Cost etc. in short run and long run.
Unit-III	**Market:** Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features). **Supply:** Supply and Law of Supply, Role of Demand and Supply in Price Determination and Effect of Changes in Demand and Supply on Prices.
Unit-IV	**Indian Economy:** Nature and Characteristics of Indian Economy as underdeveloped, developing and mixed economy (brief and elementary introduction). **Privatization:** Meaning, Merits and Demerits. **Globalization of the Indian Economy:** Merits and Demerits **Banking:** Concept of a Bank, Commercial Bank, Central Bank, Functions of a Bank, Difference between Commercial and Central Bank.

Suggested Readings:

1. Modern Microeconomics: Theory and Applications- H.L. Ahuja, S. Chand & Company Pvt. Ltd.
2. Indian Economy- S.K. Misra & V.K. Puri, Himalaya Publishing House.
3. Indian Economy: Principles and Policies- Sri Ram Srirangam, Manish Kumar, Rohit Deo Jha; Pearson Education.
4. Managerial Economics- R. Cauvery, S. Chand & Company Pvt. Ltd.
5. Microeconomic Theory- Andreu Mas-Colell, Michael D Whinston, Jerry R Green; Oxford University Press.
6. Principles of Economics- E Case Karl; C Fair Ray, Oster Sharon E, Pearson Education.

Web References:

1. https://youtu.be/IFtOcNbej0o?si=orQ9LrQH8kdlAHgn
2. https://www.youtube.com/watch?v=VU1zySe-8NA
3. https://www.youtube.com/watch?v=HylqSa58lqQ
4. https://youtu.be/ME-0GOhhZcs?si=Tl_z8CN0-bL_kPdH

Course code	**LC-ME-319A**				
Category	Professional Core Courses				
Course title	**Dynamics of Machines Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To learn the performance characteristics, stability, and sensitivity of different types of governors. ● To study gyroscopic effects and determine gyroscopic couple in rotating systems. ● To perform static and dynamic balancing of rotating masses using balancing machines. ● To determine the moment of inertia of flywheel and connecting rod using experimental methods.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Determine the effect of gyroscopic couple at different speeds.	L3: Apply
CO2	Determine the moment of inertia using experiment methods.	L3: Apply
CO3	Analyze the performance and characteristic curves for different types of governors.	L4: Analyze
CO4	Evaluate static and dynamic balancing of rotating masses.	L5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To draw performance characteristic curves, and find stability & sensitivity of Watt Governor.	**CO3**
2	To draw performance characteristic curves, and find stability & sensitivity of Porter Governor.	**CO3**
3	To draw performance characteristic curves, and find stability & sensitivity of Proell Governor.	**CO3**
4	To draw performance characteristic curves, and find stability & sensitivity of Hartnell Governor.	**CO3**
5	To perform experiments on gyroscopic effects using demonstration models.	**CO1**
6	To determine gyroscopic couple on Motorized Gyroscope.	**CO1**
7	To carry out static balancing on static balancing machine.	**CO4**
8	To carry out dynamic balancing on dynamic balancing machine.	**CO4**
9	To determine the moment of inertia of a flywheel.	**CO2**
10	Determine the moment of inertial of connecting rod by compound pendulum method.	**CO2**
11	Determine the moment of inertial of connecting rod by trifilar suspension pendulum.	**CO2**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web Reference:

1. https://dom-nitk.vlabs.ac.in/List%20of%20experiments.html

Course code	**LC-ME-321A**				
Category	Professional Core Courses				
Course title	**Fluid Machines Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To study the construction and working of turbines, pumps and hydraulic systems. ● To understand hydro power plant layout and fluid machinery applications. ● To determine the operating performance and efficiencies of hydraulic systems. ● To evaluate the performance characteristics of hydraulic turbines and pumps.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the construction details, working principle and fluid flow circuit of fluid machines.	L3: Apply
CO2	Demonstrate centrifugal and reciprocating pump and draw their characteristics curves.	L3: Apply
CO3	Determine the performance parameters and efficiencies of hydraulic devices.	L3: Apply
CO4	Analyze the performance characteristics of hydraulic turbines.	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study the constructional details of a Pelton turbine and draw its fluid flow circuit.	**CO1**
2	To draw the performance characteristics of Pelton turbine under constant head, constant speed and constant efficiency curves.	**CO4**
3	To study the constructional details of a Francis turbine and draw its fluid flow circuit.	**CO1**
4	To draw the performance characteristics of Francis turbine under constant head, constant speed and constant efficiency.	**CO4**
5	To study the construction details of a Kaplan turbine and draw its fluid flow circuit.	**CO1**
6	To draw the performance characteristics of Kaplan turbine under constant head, speed and efficiency curves.	**CO4**
7	To study the constructional details of a Centrifugal Pump and draw its characteristic curves.	**CO2**
8	To study the constructional details of a Reciprocating Pump and draw its characteristics curves.	**CO2**
9	To study the construction details of a Gear oil pump and its performance curves.	**CO3**
10	To study the constructional details of a Hydraulic Ram and determine its various efficiencies.	**CO3**
11	To study the constructional details of a Centrifugal compressor.	**CO2**

12	To study the model of Hydro power plant and draw its layout.	**CO1**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web Reference:

1. https://fmc-nitk.vlabs.ac.in/List%20of%20experiments.html
2. https://fm-iitk.vlabs.ac.in/List%20of%20experiments.html

Course code	**LC-ME-323A**				
Category	Professional Core Courses				
Course title	**Manufacturing Technology-II Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To perform basic machining operations on conventional machine tools. ● To produce threads, gears, slots, and profiles accurately. ● To learn CNC programming functions and codes. ● To prepare CNC part programs for turning and milling operations.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain conventional and non-conventional machining processes.	L2: Understand
CO2	Perform operations on lathe, milling, shaping and drilling machines.	L3: Apply
CO3	Analyze CNC codes and part programming for operations on CNC lathe machines.	L4: Analyze
CO4	Analyze CNC codes and part programming for operations on CNC milling machines.	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study and practice of orthogonal & oblique cutting on a lathe.	**CO1**
2	To machine a groove in the given work piece using milling machine.	**CO2**
3	To perform V and Dovetail machining on the given workpiece on shaping machine.	**CO2**
4	To perform drilling, counter drilling and counter sinking on drilling machine.	**CO2**
5	To perform thread cutting on a lathe forming right hand and left-hand metric threads.	**CO2**
6	Study of CNC part programming codes: G-codes, M-codes and miscellaneous functions.	**CO1**
7	Part Programming and proving on a CNC lathe for facing and straight turning.	**CO3**
8	Part Programming and proving on a CNC lathe for step turning and taper turning.	**CO3**
9	Develop and execute a CNC lathe program for external thread cutting operation.	**CO3**
10	Part Programming and Proving on a CNC Milling Machine: (a) Point to Point Programming (b) Absolute Programming (c) Incremental Programming.	**CO4**
11	Part Programming and Proving for Milling a Rectangular Slot.	**CO4**
12	Develop and execute a CNC milling program for pocket milling.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web Reference:

1. https://fab-coep.vlabs.ac.in/exp/3d-machining/theory.html
2. https://mm-nitk.vlabs.ac.in/
3. https://vlabs.iitkgp.ac.in/vmp/exp2/index.html
4. https://mm2-nitk.vlabs.ac.in/Target%20Audience.html
5. https://www.youtube.com/watch?v=2Eponh3x1kc&t=437s

<table>
<tr><td>Course Code</td><td colspan="5">PT-ME-325A</td></tr>
<tr><td>Category</td><td colspan="5">Seminar</td></tr>
<tr><td>Course Title</td><td colspan="5">Seminar-I</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are to
• To introduce circuit simulation using industry-standard software tools for electronic analysis.
• To study technical documentation, engineering processes and industry standards in real-world projects.
• To demonstrate professional communication, time management and ethical practices in industrial settings.
• to analyze engineering problems and develop solutions using industry-standard tools and methodologies.</td></tr>
<tr><td>Assessment</td><td colspan="5">25 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">50</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the organizational structure, working environment, and industrial practices of the training organization.	L2: Understand
CO2	Apply engineering knowledge to understand real-time industrial processes, tools, equipment, and systems.	L3: Apply
CO3	Prepare and present a technical training report based on observations, learning, and industrial exposure.	L3: Apply
CO4	Analyze practical problems encountered during training and relate them to theoretical concepts studied in the curriculum.	L4: Analyze

Note:

1. Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the V semester.
2. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

Course Code	**PCC-ME-302A**				
Category	Professional Core Courses				
Course Title	**Design of Machine Elements-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	4	
Course Objectives	The objectives of this course are • To introduce to the safety-critical design of machine components. • To learn the origins, nature and applicability of empirical design principles. • To study behavior of various members subjected to different types of loading. • To prepare students to solve real-world Design engineering problems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe concepts, philosophy & considerations of machine design.	L2: Understand
CO2	Calculate stresses induced in machine elements for different engineering applications.	L3: Apply
CO3	Analyze the behavior of various machine elements subjected to external loadings.	L4: Analyze
CO4	Design various machine components as per given specifications.	L5: Create

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Design Philosophy:** Problem identification, problem statement, Feasibility study covering technical, economic, financial, societal & environmental feasibility, Generation of solution field, Brainstorming, Selection of best possible solution, Preliminary design, Detailed design, Selection of Fits and tolerances and analysis of dimensional chains. **Selection of Materials:** Classification of engineering materials, mechanical properties of the commonly used engineering materials, hardness, strength characteristics, interpretation of stress–strain diagrams, Concept of Factor of safety in design.
Unit-II	**Threaded Joints and Power Screws:** ISO Metric Screw Threads, design of bolted joints under static axial, shear and eccentric loading conditions, Power Screws: Torque requirement for overcoming thread friction, efficiency of power screws, design of screw and nut **Welded Joints and Cotter Joints:** Types of welded joints, Design of various welded joints under different static load conditions, applications of cotter joint, design of socket and spigot cotter joints.
Unit-III	**Belt drives & Flywheel:** Flat & V-belt drives, Condition for Transmission of max. Power, Design of belt drives, Selection of belts, Flywheel: Turning Moment diagram, coefficient of fluctuation of energy and speed, design of solid disk & rimmed flywheels. **Keys and Couplings**: Sunk & Saddle keys, Feather, Woodruff, Kennedy Keys, Splines, Couplings design, Muff coupling, Clamp coupling, Rigid Flange Coupling, Bushed-Pin Flexible couplings.

Unit-IV	**Clutches:** Types of clutches, Torque transmitting capacity, Design of friction clutches, Single plate clutch, Multidisc clutch, Cone clutch & Centrifugal clutch, **Brakes:** Types of Brakes, Self energizing condition of brakes, Design of shoe brakes, Internal expanding brakes, Band brakes, Thermal Considerations in brake designing.

Suggested Readings:

1. Mechanical Engineering Design- Joseph Edward Shigley-MGH, New York
2. Design of Machine Elements- V.B. Bhandari, Tata McGraw Hill, New Delhi.
3. Engineering design- George Dieter, MGH, New York.
4. Machine Design- S.G. Kulkarni, Tata McGraw Hill
5. PSG Design Data Book.
6. Design Data Handbook for Mechanical Engineers- Mahadevan

Web References:

1. https://nptel.ac.in/courses/112105124
2. https://www.youtube.com/watch?v=oSKPirca1j4

Course Code	**PCC-ME-304A**				
Category	Professional Core Courses				
Course Title	**Heat Transfer**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To introduce students to the fundamental principles of heat transfer. • To provide solid understanding of conduction, convection, and radiation mechanisms. • To prepare students to solve real-world heat transfer problems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts, terminologies and laws of Heat Transfer.	L1: Remember
CO2	Explain conduction, convection, radiation, and phase change heat transfer mechanisms.	L2: Understand
CO3	Apply the laws & governing equations of heat transfer to solve the engineering problems.	L3: Apply
CO4	Analyze the performance of fins, heat exchangers, and heat transfer systems under different operating conditions.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Basics and Laws**: Definition of Heat Transfer, Modes of heat flow, Combined heat transfer system and law of energy conservation. **Steady State Heat Conduction**: Introduction, I-D heat conduction through a plane wall, long hollow cylinder, hollow sphere, Conduction equation in Cartesian, polar and spherical coordinate systems, Numerical.
Unit-II	**Steady State Conduction with Heat Generation**: Introduction, 1 – D heat conduction with heat sources, Extended surfaces (fins), Fin effectiveness 2-D heat conduction, Numerical. **Transient Heat Conduction**: Systems with negligible internal resistance, Transient heat conduction in plane walls, cylinders, spheres with convective boundary conditions, Chart solution, Relaxation Method, Numerical.
Unit-III	**Convection**: Forced Convection-Thermal and hydro-dynamic boundary layers, Equation of continuity, Momentum and energy equations, Some results for flow over a flat plate and flow through tube, Fluid friction and heat transfer (Colburn analogy), Free convection from a vertical flat plate, Empirical relations for free convection from vertical and horizontal o\planes & cylinders, Numerical. **Thermal Radiation**: The Stephen-Boltzmann law, The black body radiation, Shape factors and their relationships, Heat exchange between non-black bodies, Electrical network for radiative exchange in an enclosure of two or three gray bodies, Radiation shields, Numerical.

Unit-IV	**Heat Exchangers**: Classification, Performance variables, Analysis of a parallel/counter flow heat exchanger, Heat exchanger effectiveness, Numerical. **Heat Transfer with Change of Phase**: Laminar film condensation on a vertical plate, dropwise condensation, boiling regimes, Free convective, Nucleate and film boiling, Numerical.

Suggested Readings:

1. Heat and Mass Transfer — R. K. Rajput, S. Chand Publications.
2. Heat Transfer — Yunus A. Çengel and Afshin J. Ghajar, McGraw Hill.
3. Heat Transfer — J. P. Holman, McGraw Hill Education.
4. Heat Transfer — P. K. Nag, McGraw Hill Education.
5. Heat and Mass Transfer — Dr. D. S. Kumar, S. K. Kataria & Sons.

Web Reference:

1. https://nptel.ac.in/courses/112105771
2. https://nptel.ac.in/courses/103103031
3. https://nptel.ac.in/courses/112106315
4. https://nptel.ac.in/courses/112107211
5. https://nptel.ac.in/courses/112107256

Course Code	**PCC-ME-306A**				
Category	Professional Core Courses				
Course Title	**Internal Combustion Engines and Gas Turbines**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals of IC engines, classifications, and air standard cycles (Otto, Diesel, Dual cycles). • To familiarize with fuel supply systems, combustion processes, and ignition systems in S.I. and C.I. engines. • To learn lubrication, cooling systems, engine performance parameters, and testing methods. • To develop supercharging, gas turbine cycles, emission control techniques, and alternative fuels.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the basic concepts, components, systems, and performance parameters of I.C. engines and gas turbines.	L1: Remember
CO2	Explain the working and operating characteristics of various systems of I.C engine.	L2: Understand
CO3	Apply thermodynamic and engineering principles to solve problems related to I.C. engines and gas turbine systems.	L3: Apply
CO4	Analyze the effect of operating variables on the performance of I.C engines & gas turbines.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction and Air Standard Cycles**: Internal and external combustion engines; classification of I.C. Engines, four stroke and two stroke I.C. Engines, Air standard cycles; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; deviation of actual engine cycle from ideal cycle. Problems. **Carburetion, fuel Injection and Ignition systems**: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.
Unit-II	**Combustion in I.C. Engines**: Stages of combustion in S.I. Engines; factors affecting the ignition lag and velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

	Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.
Unit-III	**Engine Testing and Performance**: Performance parameters, measurement of operating parameters- BHP, IHP, brake mean effective pressure, indicative mean effective pressure, torque, specific fuel consumption (BSFC, ISFC), efficiencies - thermal efficiency, mechanical efficiency, volumetric efficiency; heat balance; Problems. **Air pollution from I.C. Engine and Its Remedies**: Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front.
Unit-IV	**Supercharging**: Objectives of supercharging, its advantages and applications; Turbocharging and supercharging of SI and CI Engines; limitations of supercharging. **Gas Turbines**: Brayton cycle; open and closed types of gas turbine plants; improvements of the basic gas turbine cycle; multi stage compression with intercooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.

Suggested Readings

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.
3. Internal Combustion Engines- R. K. Rajput, Laxmi Publications.
4. Engineering fundamental of the I C Engine – Willard W. Pulkrabek, PHI, India
5. Internal Combustion Engines & Air pollution- Obert E.F, Hopper & Row Pub., New York
6. Internal Combustion Engines Fundamentals- John B. Heywood, McGraw Hill, New York

Web Reference:

1. https://nptel.ac.in/courses/112103316
2. https://nptel.ac.in/courses/112103262
3. https://nptel.ac.in/courses/112103275
4. https://nptel.ac.in/courses/112103313
5. https://www.youtube.com/watch?v=Kur5XTwmlGc

Course Code	**PCC-ME-308A**				
Category	Professional Core Courses				
Course Title	**Mechanical Measurements**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide a basic knowledge about measurement systems and their components. • To learn about various sensors used for measurement of mechanical quantities. • To learn about system stability. • To integrate the measurement systems with the process for process monitoring.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify the fundamental concepts, terminology, and characteristics of measurement systems.	L1: Remember
CO2	Explain the working principles and applications of transducers and measurement devices.	L2: Understand
CO3	Apply techniques for the measurement of performance, motion, force, torque, temperature, pressure, and flow.	L3: Apply
CO4	Analyze the performance and accuracy of measurement systems and instrumentation devices for engineering applications.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Measurement systems and performance:** Introduction, scope, and method of measurements and instruments, generalized measurement system, standard, and calibration. Static characteristics, dynamic characteristics, error in measurement, types of error, uncertainty analysis
Unit-II	**Transducer Elements:** Introduction, Analog and Digital Transducers, Inductive, Resistive, and Capacitive Strain Gages, Strain Gage Bridge circuits, Temperature Compensation, Balancing and Calibration, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Voltaic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.
Unit-III	**Motion, Force and Torque Measurement:** Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moiré-Fringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Torque Meter.

	Temperature Measurement: Introduction, Measurement of Temperature, Non-Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods – Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.
Unit-IV	**Pressure and Flow Measurement:** Pressure & Flow Measurement, Introduction: Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing, Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Suggested Readings:

1. A Text Book of Engineering Metrology- R.K. Jain, Khanna Publishers.
2. Mechanical Measurement & Control- D.S. Kumar, Metropolitan book Co.
3. Instrumentation and control systems- W. Bolton, Newnes
4. Mechanical measurement and instrumentation- R K Rajput, S K Kataria & Sons.
5. Mechanical Measurements- Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, Pearson Education India.
6. Process/Industrial Instruments and Controls Handbook- Gregory K. McMillan, McGraw-Hill: New York.

Web Reference:

1. https://nptel.ac.in/courses/112103261
2. https://nptel.ac.in/courses/112107242
3. https://nptel.ac.in/courses/112106138
4. https://nptel.ac.in/courses/112106140
5. https://nptel.ac.in/courses/112106139

Course Code	**PEC-ME-310A**				
Category	Professional Elective Courses				
Course Title	**Gas Dynamics and Jet Propulsion**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To study the fundamentals of compressible flow concepts. • To learn the compressible flow behaviour in constant area ducts. • To study the development of shock waves and its effects. • To familiar with types of jet engines and their performance parameters. • To introduce to the types of rocket engines and their performance parameters.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts and terminology related to compressible flow and propulsion systems.	L1: Remember
CO2	Explain the behavior of compressible flow, shock waves, and propulsion systems.	L2: Understand
CO3	Apply the governing equations and principles to solve compressible flow and propulsion problems.	L3: Apply
CO4	Analyze the working, performance, and operational characteristics of compressible flow systems, jet engines, and rocket propulsion systems.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Basic Concepts and Isentropic Flows**: Concepts of compressible flow- Mach waves and Mach cone; stagnation states; momentum and energy equations of one-dimensional flow; Isentropic flow through variable area ducts, nozzles and diffusers; subsonic and supersonic flow through variable area ducts, choked flow; Area-Mach number relations for isentropic flow.
Unit-II	**Compressible Flow Through Ducts**: Flow through constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables.
Unit-III	**Jet Propulsion**: Theory of jet propulsion; thrust equation; thrust power and propulsive efficiency; operating principle and cycle analysis of ram jet, turbojet, turbofan and turboprop engines.
Unit-IV	**Space Propulsion**: Types of rocket engines; propellants & feeding systems; ignition and combustion; theory of rocket propulsion; performance study, staging, terminal and characteristic velocity, space flights

Suggested Readings

1. Modern Compressible flow- John David Anderson, McGraw Hill.
2. Fundamentals of Gas Dynamics- Robert D. Zucker & Oscar Biblarz, John Wiley & Sons Inc.
3. Gas Dynamics- Rathakrishnan E, Prentice Hall of India, New Delhi.
4. Fundamentals of Compressible Flow with Aircraft and Rocket propulsion- S.M. Yahya, New Age International Publishers.
5. Gas Turbines- V Ganesan, Tata McGrawHill, New Delhi.
6. Principles of Jet Propulsion and Gas Turbines- N J Zucrow, John Wiley, New York

Web Reference:

1. https://nptel.ac.in/courses/112103021
2. https://nptel.ac.in/courses/101106044
3. https://nptel.ac.in/courses/112106196
4. https://nptel.ac.in/courses/112106166

<table>
<tr><td>Course Code</td><td colspan="5">PEC-ME-312A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Industrial Robotics</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To introduce to the fundamentals and industrial applications of robotic systems.
• To provide knowledge of robot actuators, end effectors, and sensory devices used in automation and intelligent manufacturing systems.
• To learn robot motion, coordinate transformations, and kinematic behavior of robotic manipulators.
• To enhance analytical and problem-solving skills for the design, control, and application of robotic systems in modern industries.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">100</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts, components, and terminology used in robotics systems.	L1: Remember
CO2	Explain the working principle of robot actuators, end effectors, sensors, and robotic systems.	L2: Understand
CO3	Apply robotic sensing, actuator systems, and kinematic to solve manipulator and motion-related problems.	L3: Apply
CO4	Analyze the robotic system performance, sensor integration, and manipulator kinematics for automation applications.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Robotics**: Major component of a robot, robotic like devices, classification of robots - Classification by coordinate system and by control method, Specifications of robots, fixed versus flexible automation, economic analysis and overview of robot application in industry.
Unit-II	**Robot End Effectors**: Introduction, end effectors, interfacing, types of end effectors, grippers and tools, considerations in the selection and design of remote centered devices, Requirements of End effectors. **Robot Actuators**: Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives.

Unit-III	**Robotic Sensory Devices**: Objective, non-optical position sensors - potentiometers, synchros, inductosyn, optical position sensors – optical interrupters, optical encoders (absolute & incremental) Proximity Sensors: Contact type, non-contact type – inductive, capacitive proximity sensor, fiber optic proximity sensor, laser scanning proximity sensor, and reflected light sensor. **Touch & Slip Sensors**: Touch sensors - proximity rod & photo detector sensors, slip sensors - Forced oscillation slip sensor, interrupted type slip sensors.
Unit-IV	**Transformations and Kinematics**: Objectives, homogenous coordinates, basic transformation operations, homogeneous transformation. **Forward solution** – Denavit Hartenberg procedure. Problems involving 2 and 3 DOF manipulators and SCARA manipulator. Inverse or backward solution - Closed form solution, problems involved articulated manipulators and SCARA manipulator.

Suggested Readings

1. Robotic Engineering- Richard D. Klafter, Prentice-Hall of India Pvt Ltd.
2. Industrial Robotics- Mikell P. Groover, Tata McGraw-Hill Int.
3. Robotics and Control- R.K. Mittal and I. J. Nagrath, TMH.
4. Introduction To Robotics: Mechanics And Control- John J. Craig, Pearson.
5. Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, Prentice Hall.
6. Robotics: Control, Sensing, Vision, and Intelligence- K. S. Fu, R. C. Gonzales, and C.S. G. Lee, Tata McGraw-Hill.

Web Reference:

1. https://nptel.ac.in/courses/112105319
2. https://nptel.ac.in/courses/107106090
3. https://nptel.ac.in/courses/112101098
4. https://nptel.ac.in/courses/112104298

Course Code	**PEC-ME-314A**				
Category	Professional Elective Courses				
Course Title	**Quality Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To understand the fundamental concepts of quality, quality control, TQC, and quality systems used in manufacturing and service industries. • To use statistical concepts and control charts for quality analysis and process control. • To know the quality systems, ISO 9000 standards, and industrial inspection methods. • To study and implement Total Quality Management (TQM) philosophies and modern quality improvement techniques such Kaizen, JIT, Six Sigma, and 5-S approach.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the concepts of quality engineering.	L1: Remember
CO2	Explain the quality systems, elements of TQC and different forms of Inspection.	L2: Understand
CO3	Apply the concepts of statistical quality control and quality management in real life scenario.	L3: Apply
CO4	Analyze various quality parameters, approaches for quality management, control and improvement.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Basic Concepts of Quality:** Definitions of Quality and its importance in industry, Quality function, Quality dimensions, Quality Characteristics, Quality process, Quality Traits, Applications of Quality, Quality costs concept and Quality cost categories. **Quality Control**: Introduction to quality control, Computer aided quality control, Total quality control (TQC) and its implementation, Elements of TQC, Quality Circle, Objectives of quality circle, Role of management in quality circle and Quality in service organizations
Unit-II	**Basic Statistical Concepts:** The Concept of variation, Distinction between variables and attributes data, The frequency distribution, graphical representation of frequency distribution. **Control chart for variables & attributes:** control chart for attributes- X-bar and R charts, control chart for individual measurement, Application of variable control charts, Control chart for attributes- P- chart, np-chart, c-chart and applications

Unit-III	**Quality systems:** Quality systems, need for quality System, Need for standardization, History of ISO:9000 series standards and its features, steps to registration, India and ISO:9000. **Inspection Systems and Industrial Applications**: Introduction to Inspection Systems, Different forms of Inspection, Automated inspection systems technologies, Industrial inspection.
Unit-IV	**Total Quality Management:** Introduction to TQM, Concepts & elements of TQM, Characteristics of TQM, Relevance of TQM, Approaches to TQM Implementation, TQM philosophies. **Tools and techniques in TQM:** PDCA cycle, Taguchi Philosophy, JIT, Kaizen, Six Sigma approach, 5-S approach, Benchmarking, Total productive maintenance

Suggested Readings:

1. Quality planning and Analysis- Joseph M. Juran and Frank M. Gryna, McGraw-Hill.
2. Quality control- Dale H. Besterfield.
3. Quality Management- Kanishka Bedi, Oxford University Press, New Delhi.
4. Fundamentals of quality control and improvement- Amitava Mitra, Wiley.
5. Statistical Quality Control- M. Mahajan, Dhanpat Rai Publications, New Delhi.

Web Reference:

1. https://nptel.ac.in/courses/110101010
2. https://nptel.ac.in/courses/110101150
3. https://nptel.ac.in/courses/110104080
4. https://www.youtube.com/@totalqualitymanagement-i5523
5. https://www.youtube.com/watch?v=NsgiCkRmAAc

Course Code	**PEC-ME-316A**				
Category	Professional Elective Courses				
Course Title	**Smart Materials**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce basic concepts of smart materials, intelligent systems, and biomimetic materials. • To familiar with principles of actuators, sensors, and smart structural systems. • To learn processing methods, shape memory alloys, and battery materials. • To analyze nanoscale materials, nanotubes, and their functional properties for applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts of smart materials, smart systems, and nanoscale materials.	L1: Remember
CO2	Explain the principles of smart materials, processing techniques, SMA, battery materials, and nanomaterial structures.	L2: Understand
CO3	Apply concepts of smart materials, structural systems, composite materials, and nanotube-based systems to engineering problems.	L3: Apply
CO4	Analyse properties and performance of smart materials, smart structures, energy systems, and nanoscale materials for applications.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fundamentals of Smart Materials:** Introduction to smart materials, definition and key concepts of smart materials, basic principles behind smart properties, classification of smart materials according to production technologies and industrial applications, approaches to fabrication of smart materials, and properties of smart materials. **Intelligent and Biomimetic Materials:** Nanoscale and microscale structure–property relationships, intelligent materials and their primitive functions, intelligence inherent in materials, intelligent materials in harmony with humanity, intelligent biological materials, and biomimetics.
Unit-II	**Smart materials and structural systems:** Introduction, actuator materials, sensing technologies, micro-sensors, hybrid smart materials, passive smart structures, active smart structures, hybrid intelligent systems, smart skins. **Processing of Smart Materials:** Processing of Smart Materials Semiconductors and their processing, Metals and metallization techniques, Ceramics and their processing, Polymers and their synthesis, UV radiation curing of polymers, fluids.

Unit-III	**Shape Memory Alloys and Composite Materials:** Introduction to shape memory alloys, basic properties and characteristics, phase transition, shape-memory effect, super-elasticity, metal matrix composites, polymer matrix composites, and engineering applications of composites. **Smart Battery Materials and Energy Storage Systems:** Introduction to smart battery materials, electrochemical concepts involved in a battery, basic battery components and working principles, types of batteries, lithium-ion batteries, layered oxide cathodes, and applications of smart batteries in modern energy storage systems.
Unit-IV	**Nanoscale Intelligent Materials and Nanotube Structures:** Introduction to nanoscale intelligent materials, basic concepts of nanotechnology, nanotube geometric structures, structures of carbon nanotubes, fabrication methods, and applications of nanostructured materials. **Properties and Functional Behavior of Nanotubes:** Mechanical and physical properties of nanotubes, elastic properties, electrical conductivity, piezoelectric properties, electrochemical effects, and engineering applications of nanotube-based smart materials.

Suggested Readings:

1. Industrial Smart Material Systems and MEMS: Design and Development Methodologies, V. K. Varadan, K. J. Vinoy, S. Gopalakrishnan, John Wiley and Sons, England, 2006
2. Smart Structures and Materials, Brain Culshaw, Artech House, London, 1996
3. Smart Materials and Structures, Mukesh V. Gandhi, Brian S. Thompson, Springer, May- 1992.
4. Smart Structures: Analysis and Design, A. V. Srinivasan, Cambridge University Press, Cambridge, New York, 2001.

Web Reference:

1. http://acl.digimat.in/nptel/courses/video/112104251/L01.html
2. https://nptel.ac.in/courses/113104009
3. https://www.youtube.com/watch?v=b5IPJeCDEPw
4. https://nptel.ac.in/courses/118104008

Course Code	**PEC-ME-318A**				
Category	Professional elective Courses				
Course Title	**Plant Maintenance Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts, functions, and objectives of maintenance and plant engineering systems. • To familiarize with the various aspects of plan maintenance engineering. • To provide the knowledge of facility planning, plant layout, and spare parts management for efficient industrial operations. • To enhance the problem-solving skills for improving plant performance, reliability, and maintenance efficiency.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamental concepts, terminology, and functions of maintenance and plant engineering systems.	L1: Remember
CO2	Explain the plant maintenance principles, strategies, planning, and inventory control techniques used in industries.	L2: Understand
CO3	Apply the principles, strategies, and management aspects of plant maintenance for industrial systems.	L3: Apply
CO4	Analyze maintenance systems, facility planning, and resource management practices for effective plant operations.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Principles and Practices of Maintenance**:-Awareness on maintenance and plant engineering maintenance, objectives of maintenance and plant engineering, state of plant, functions and responsibilities; Installation, commissioning, spare part management function, utility and service function, maintenance planning function, physical assets management, Basic Principles of maintenance planning – Planning function in maintenance, maintenance organization, systems of plant engineering and management, decentralization in plant engineering, advantages and drawbacks of decentralization, staffing in plant engineering, Directing, plant engineering and management as integrating function.
Unit-II	**Maintenance Strategies**: Introduction, failure-based maintenance, contractual maintenance, reliability centered maintenance, Time based maintenance, Condition based maintenance, maintenance strategy, hurdles in formulating maintenance strategy. Maintenance procedure and their selection, characteristics of maintenance strategy.

Unit-III	**Facility Planning and Plant Layout**: Introduction, objectives of good facility planning, principles of facility layout, facility location study, facilities governing selection of location, steps in facility location study, plant layout, flow patterns to facilities assembly lines.
Unit-IV	**Spare Parts Management**: Introduction, features/characteristics of spare parts, functions of spare parts management, classification of spare parts- ABC analysis, SDE Analysis, VED Analysis, CIN Analysis, HML analysis, XYZ analysis, maintenance system optimization, codification, standardization, levels of standards, advantages of standardization, barriers to standardization

Suggested Readings

1. Industrial Maintenance Management- S.K Srivastava, S. Chand and Company
2. Installation, Servicing and Maintenance- S.N Bhattacharya, S. Chand and Company
3. Maintenance Engineering- H.P. Garg, S. Chand and Company
4. Maintenance Engineering Hand book- L.R Higgins, McGraw Hill.

Web Reference:

1. https://www.youtube.com/watch?v=f58SW0Hwcf0
2. https://www.youtube.com/watch?v=H-hEH68Knkc
3. http://digimat.in/nptel/courses/video/112107241/L11.html
4. https://www.youtube.com/watch?v=EI38RPfN5Mo
5. https://onlinecourses.swayam2.ac.in/e-learning/preview/nou21_me10

<table>
<tr><td>Course Code</td><td colspan="5">SM-ME-326A</td></tr>
<tr><td>Category</td><td colspan="5">Seminar</td></tr>
<tr><td>Course Title</td><td colspan="5">Seminar</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are to
• Develop technical presentation, communication and interpersonal skills.
• Enhance the ability to review and interpret technical literature.
• Promote awareness of emerging technologies and contemporary engineering developments.
• Strengthen technical report writing, documentation, and professional discussion skills.</td></tr>
<tr><td>Assessment</td><td colspan="5">50 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">---</td></tr>
<tr><td>Total Marks</td><td colspan="5">50</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">---</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify emerging technologies, recent developments, and contemporary issues in engineering.	L1: Remember
CO2	Explain the selected topic by interpreting technical information obtained from multiple authentic sources.	L2: Understand
CO3	Prepare a technical report and deliver an effective seminar presentation using appropriate communication and presentation tools.	L3: Apply
CO4	Analyze the significance, challenges, and future scope of the selected engineering topic.	L4: Analyze

Guidelines:

- Each student shall select a seminar topic related to Mechanical Engineering or allied emerging technologies in consultation with the faculty mentor.
- A seminar report shall be prepared in the prescribed format and submitted before the seminar presentation.
- Each student shall deliver a technical presentation followed by an interactive question-and-answer session.
- Evaluation shall be based Technical Knowledge & Conceptual Clarity, Presentation & Communication Skills Technical Discussion & Viva-Voce, Seminar Report Innovation & Future Scope
- Students are encouraged to use presentation aids such as slides, demonstrations, simulations, videos, or prototypes etc. wherever applicable.

Course Code	**MC-301A**				
Category	Mandatory Non-Credit Courses – Audit Courses				
Course Title	**Essence of Indian Traditional Knowledge**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	2	0	0		
Course Objectives	The objectives of this course are • To make the students familiar with the fundamentals, structure, and components of the Indian Knowledge System including Vedas, Upavedas, Vedangas, and Upangas. • To develop the understanding of students regarding the relationship between modern science and the Indian Knowledge System. • To familiarize the students with the principles of yoga, holistic healthcare, and their significance in physical and mental well-being. • To make the students learn the practical relevance and applications of the Indian Knowledge System through case studies and interdisciplinary approaches.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe the concepts related to the Indian Knowledge System, Vedas, Upavedas, Vedangas, Upangas, yoga, and holistic healthcare.	L1: Remember
CO2	Explain the structure, principles, and interdisciplinary relevance of the Indian Knowledge System in relation to modern science and healthcare practices.	L2: Understand
CO3	Apply the concepts of yoga, holistic healthcare, and Indian Knowledge traditions for promoting well-being and understanding their practical significance in contemporary society.	L3: Apply
CO4	Analyze the contributions and applications of the Indian Knowledge System in science, healthcare, education, and societal development through case studies and interdisciplinary perspectives.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Contents

- Basic Structure of Indian Knowledge System: Ashtadasha Vidya (Eighteen Branches of Knowledge in the Indian Knowledge System), Veda, Upaveda (Ayurveda, Dhanurveda, Gandharvaveda, Sthapatyaveda etc.), Vedanga (Shiksha, Kalpa, Nirukta, Vyakarana, Jyotisha, Chhanda), Upanga (Dharmashastra, Mimansa, Purana, Tarkashastra).
- Modern Science and Indian Knowledge System.
- Yoga and Holistic Healthcare.
- Case Studies.

Suggested Readings:

- Cultural Heritage of India – Course Materials by V. Sivaramakrishnan, Bharatiya Vidya Bhavan, Mumbai
- Modern Physics and Vedant by Swami Jitatmanand, Bharatiya Vidya Bhavan
- Holistic Science and Vedant by Swami Jitatmanand, Bharatiya Vidya Bhavan
- Tarkasangraha of Annam Bhatta by V. N. Jha (English Translation), International Chinmaya Foundation, Veliyanad, Ernakulam
- Yoga Sutra of Patanjali by Ramakrishna Mission, Kolkata
- Yoga-Darshanam with Vyasa Bhashya by G. N. Jha (English Translation), Edited by R. N. Jha, Vidyanidhi Prakashan, Delhi
- Science of Consciousness, Psychotherapy and Yoga Practices by R. N. Jha, Vidyanidhi Prakashan, Delhi
- Shodashang Hridayam by P. B. Sharma (English Translation)

Course code	**LC-ME-220A**				
Category	Professional Core Courses				
Course title	**Heat Transfer Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To familiarize students with different modes of heat transfer and related experimental techniques. ● To enable students to determine thermal properties and heat transfer coefficients using standard experimental methods. ● To develop the ability to analyse heat transfer behaviour in conduction, convection, radiation, and heat exchangers. ● To develop practical skills for conducting experiments, interpreting results, and comparing theoretical and experimental heat transfer performance.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the principles and mechanisms of conduction, convection, radiation, and phase change heat transfer.	L2: Understand
CO2	Determine the thermal conductivity of metal rod and power using experimental method.	L3: Apply
CO3	Determine the heat transfer coefficient and emissivity using experimental method.	L3: Apply
CO4	Analyze the performance of fins and heat exchangers using experimental observations and heat transfer principles.	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To determine the thermal conductivity of a metal rod.	**CO2**
2	To determine the thermal conductivity of insulating powder.	**CO2**
3	To analyze the temperature distribution along a pin fin and its efficiency/effectiveness.	**CO4**
4	To determine heat transfer coefficient in natural convection from a vertical/horizontal cylinder.	**CO3**
5	To determine the heat transfer coefficient for forced convection through a pipe/duct.	**CO3**
6	To verify Stefan–Boltzmann law for thermal radiation.	**CO3**
7	To determine the emissivity of a given surface.	**CO3**
8	To analyze the overall heat transfer coefficient and effectiveness of a parallel-flow heat exchanger.	**CO4**
9	To analyze the overall heat transfer coefficient and effectiveness of a counter-flow heat exchanger.	**CO4**
10	To determine radiation shape factor between surfaces.	**CO3**

11	To study pool boiling heat transfer and plot the boiling curve.	**CO1**
12	To study of thermal conductivity of a liquid.	**CO1**
13	To study dropwise and film wise condensation phenomenon.	**CO1**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web Reference:

1. https://ht-nitk.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/index.php?sub=1&brch=194
3. https://learncheme.com/simulations/heat-transfer/

Course code	**LC-ME-222A**				
Category	Professional Core Courses				
Course title	**Mechanical Measurements Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To learn about the applications of measurement systems. ● To know about the basics and working principle of pressure, temperature and flow measurement. ● Identify the different variation of measurement parameter with various input conditions. ● To analyse the primary, secondary and tertiary measurements. ● To learn about the various control devices and parts of measurement systems.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the working principles and characteristics of mechanical measurement instruments and transducers.	L2: Understand
CO2	Measure temperature, pressure, displacement, force, torque, speed, and flow parameters.	L2: Understand
CO3	Determine stress, strain, and flow characteristics using measurement and instrumentation techniques.	L3: Apply
CO4	Analyze measurement errors, calibration methods, and performance characteristics of measurement systems.	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study various temperature measuring instruments such as mercury-in-glass thermometer and thermocouple.	**CO1**
2	To analyze the Bourdon pressure gauge and calibrate it using a dead weight pressure gauge tester.	**CO4**
3	To study the working of Linear Variable Differential Transformer (LVDT) and measure small displacement.	**CO2**
4	To measure tensile/compressive load using a load cell.	**CO2**
5	To measure torque of a rotating shaft using torsion meter/strain gauge torque transducer.	**CO2**
6	To measure the speed of a rotating shaft using non-contact type pick-ups.	**CO2**
7	To measure stress and strain using strain gauges mounted on beams.	**CO3**
8	To study the construction and working of hot wire anemometer.	**CO1**
9	To analyze the various types of measurement errors and uncertainty mechanical measurement systems.	**CO4**
10	To study the construction and working of rotameter.	**CO1**

11	To measure flow rate using venturi meter/orifice meter.	**CO3**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Course code	**LC-ME-224A**				
Category	Professional Core Courses				
Course title	**Internal Combustion Engines Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To study the construction and working principles of I.C engines and gas turbines. ● To learn fuel supply, ignition systems, lubrication, and cooling systems of I.C. engines. ● To perform experimental procedures and performance tests on engines. ● To analyse engine performance characteristics and prepare performance curves and heat balance sheets.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the components, systems, and operating principles of I.C. engines and gas turbines.	L2: Understand
CO2	Determine the efficiencies and operating characteristics of petrol and diesel engines.	L3: Apply
CO3	Determine IHP, FHP, heat balance of an I.C. engine using experimental methods.	L3: Apply
CO4	Analyze the effect of operating conditions on engine performance, fuel consumption, and emissions.	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study the constructional details & working of two-stroke/ four stroke petrol engine.	CO1
2	To study the constructional detail & working of two-stroke/ four stroke diesel engine.	CO1
3	To study the different types of fuel injection systems used in I.C. engines.	CO1
4	To study lubrication and cooling systems used in I.C. engines.	CO1
5	To study battery ignition systems used in I.C. engines.	CO1
6	To conduct performance test on a petrol engine to determine the BHP, fuel consumption, and efficiencies.	CO2
7	To conduct performance test on a diesel engine to determine the BHP, fuel consumption, and efficiencies.	CO2
8	To determine the volumetric efficiency and mechanical efficiency of an I.C. engine.	CO2
9	To prepare heat balance sheet for a multi-cylinder diesel engine/petrol engine.	CO3
10	To determine the indicated horse power (IHP) of a multi-cylinder petrol engine/diesel engine using the Morse test.	CO3

11	To determine the FHP of a multi-cylinder diesel engine/petrol engine using Willian's line method & by motoring method.	CO3
12	To analyze the effect of speed variation on the performance characteristics of petrol/diesel engines and plot curves (i) BHP, IHP, FHP, vs speed (ii) volumetric efficiency & indicated specific fuel consumption vs speed.	CO4
13	To analyze the effect of constant speed on the performance characteristics of petrol/diesel engines and plot curves of (i) BHP vs fuel rate, air rate and A/F and (ii) BHP vs MEP, Mech efficiency & SFC.	CO4
14	To analyze of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.	CO4

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web Reference:

1. https://vlab.amrita.edu/index.php?sub=1&brch=194
2. https://www.vlab.co.in/broad-area-mechanical-engineering

Annexure AC/5.34

~~Annexure 4.4~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examinations

(Under NEP-2020)

B-SCHEME

Bachelor of Technology (Mechanical Engineering)

Effective from

Academic Session 2026-27 (2nd Year)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	1 Practical (P) per week	0.5 Credit
4	1 Project/Seminar/Practical Training/Internship per week	0.5 Credit

2. RANGE OF CREDIT

A range of credits from 160 to 180 for a student to be eligible to get Under Graduate degree in Mechanical Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B. TECH)

Sr. No.	**Category**	**Breakup of Credits**
1	Basic Science Courses	21*
2	Engineering Science Courses	22*
3	Professional Core Courses	73*
4	Professional Elective Courses	12*
5	Humanities and Social Sciences including Management Courses	12*
6	Multidisciplinary Open Electives Courses	09*
7	Value Added Courses	03*
8	Project work, seminar and internship in industry or appropriate work place/ academic and research institutions in India/abroad	18*
9	Mandatory Non-Credit Courses (Audit Course)	(Non-Credit)
	Total Credits	**170***

**Minor variation is allowed as per need of the respective disciplines.*

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Basic Science Courses	BSC
2	Engineering Science Courses	ESC
3	Professional Core Courses	PCC
4	Professional Elective Courses	PEC
5	Humanities and Social Sciences including Management Courses	HSMC
6	Multidisciplinary Open Electives Courses	OEC
7	Value Added Courses	VAT
8	Project	PR
9	Practical Training	PT
10	Seminar	SM
11	Internship	INT
12	Mandatory Non-Credit Courses (Audit Course)	MC
13	Laboratory Courses	LC

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA JHAJJAR (HR.)

Scheme of Studies and Examinations

B. Tech (Mechanical Engineering) – 3rd Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ME-201B	Thermodynamics	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	PCC-ME-203B	Computer Aided Design & Manufacturing	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	PCC-ME-205B	Materials & Metallurgy	3	0	0	3	3	30	45		75	3
4	Engineering Science Courses	ESC-ME-207B	Engineering Mechanics	3	0	0	3	3	30	45		75	3
5	Basic Science Courses	BSC-ME-209B	Mathematics-III	3	1	0	4	4	40	60		100	3
6	Humanity Science & Management Courses	HSMC-01B	Fundamentals of Management and Organizational Behaviour	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-ME-211B	Materials & Metallurgy Lab	0	0	2	2	1	10		15	25	-
8	Professional Core Courses	LC-ME-213B	Computer Aided Design & Manufacturing Lab	0	0	2	2	1	10		15	25	-
9	Engineering Science Courses	LC-ME-215B	Engineering Mechanics Lab	0	0	2	2	1	10		15	25	-
10	Mandatory Non-Credit Course	MC-201B	Environmental Science	2	0	0	2		20	30			3
Total Credits								**23**				**575**	

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA JHAJJAR (HR.)

Scheme of Studies and Examinations

B. Tech (Mechanical Engineering) – 4th Semester

W.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ME-202B	Applied Thermodynamics	3	0	0	3	3	30	45		75	3
2	Professional Core Courses	PCC-ME-204B	Strength of Materials	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	PCC-ME-206B	Fluid Mechanics	3	0	0	3	3	30	45		75	3
4	Professional Core Courses	PCC-ME-208B	Kinematics of Machines	3	0	0	3	3	30	45		75	3
5	Professional Core Courses	PCC-ME-210B	Manufacturing Technology-I	3	0	0	3	3	30	45		75	3
6	Professional Elective Courses	----------	**Refer Table 1**	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-ME-220B	Applied Thermodynamics Lab	0	0	2	2	1	10		15	25	-
8	Professional Core Courses	LC-ME-222B	Strength of Materials Lab	0	0	2	2	1	10		15	25	-
9	Professional Core Courses	LC-ME-224B	Fluid Mechanics Lab	0	0	2	2	1	10		15	25	-
10	Professional Core Courses	LC-ME-226B	Kinematics of Machines Lab	2	0	0	2	1	10		15	25	-
11	Professional Core Courses	LC-ME-228B	3D Printing Lab	2	0	0	2	1	10		15	25	-
Total Credits								**23**				**575**	

Note: At the end of 4th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and its evaluation shall be carried out in the 5th Semester. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

Table 1: Professional Elective Course-I

Sr. No.	Course Code	Course Title
1	PEC-ME-212B	Industrial Engineering
2	PEC-ME-214B	3D Printing
3	PEC-ME-216B	CNC Technology
4	PEC-ME-218B	Composite Materials
5		Any one of the MOOCs not studied earlier and of equal credits (3)

Note: Students have to select any one course from the above list of courses, provided that the course has not been studied earlier.

Course Code	**PCC-ME-201B**				
Category	Professional Core Courses				
Course Title	**Thermodynamics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts and principles of thermodynamics. • To know thermodynamic processes involving entropy, availability, and irreversibility. • To learn thermodynamic relationships for analyzing the behaviour of pure substances and real systems. • To inculcate problem-solving skills related thermal engineering practice.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the thermodynamic concepts, laws, and properties of pure substances.	L1: Remember
CO2	Explain the laws, entropy, thermodynamic relations and energy interactions in various processes.	L2: Understand
CO3	Apply thermodynamic laws and equations to solve thermodynamic systems.	L3: Apply
CO4	Analyze behaviour and efficiency of system using thermodynamic properties and relations.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Basic concept:** Thermodynamic system, surrounding & boundary, thermodynamics properties – intensive & extensive, thermodynamic equilibrium, state, path, process & cycle, reversible & irreversible processes, path and point function, Quasi-static process. Zeroth law of thermodynamics, temperature scales; methods of temperature measurement. **First Law of thermodynamics:** Joules experiments, first law of thermodynamics for cyclic and non-cycle processes, internal energy and enthalpy, first law applied to non- flow process.
Unit-II	**First Law of thermodynamics for flow processes:** Derivation of general energy equation for a control volume, steady state steady flow energy equation, throttling process and free expansion process. Problems. **Second Law of Thermodynamics:** Limitations of the first law of thermodynamics, thermal reservoir, heat source & heat sink, heat engine and heat pump, Kelvin- Planck and Clausius Statements and their Equivalence, PMMSK, Carnot Cycle, Carnot heat engine and Carnot heat pump, Carnot theorem and its corollaries.

Unit-III	**Entropy:** Definition of entropy**,** demonstration that entropy is a property, Clausius inequality, principle of entropy increase, temperature entropy plot, entropy change in different processes, introduction to Third Law of Thermodynamics. Problems. **Availability& Irreversibility:** High- and Low-Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility, Second law efficiencies of processes & cycles. Problems.
Unit-IV	**Pure Substances:** Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling, Saturated and Superheat Steam, Solid – Liquid –Vapor Equilibrium, T-V, P-V and P-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature –Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam. Problems. **Thermodynamic Relations:** Maxwell's Equations, TdS Equations, Difference in Heat Capacities, Ratio of Heat Capacities, Energy Equation, Clausius- Clapeyron Equation, Gibbs Phase Rule, Types of Equilibrium, Third Law of Thermodynamics.

Suggested Readings:

1. Thermal Science and Engineering - D.S Kumar, Laxmi Publisher, 6th Edition.
2. Thermodynamics: An Engineering Approach - Yunus A. Cengel, Michael A. Boles, McGraw Hill.
3. Fundamentals of Engineering Thermodynamics - Moran, M. J. and Shapiro, H. N, John Wiley and Sons.
4. Engineering Thermodynamics – PK Nag, Tata McGraw-Hill Publishing Co. Ltd
5. Applied Thermodynamics - R. Yadav, Central Publishing House.
6. Fundamentals of Classical Thermodynamics, Gordon J. Van Wylen and Richard E. Sonntag, WILEY.

Web References:

1. https://nptel.ac.in/courses/101104063
2. https://nptel.ac.in/courses/112102255
3. https://nptel.ac.in/courses/112105220
4. https://nptel.ac.in/courses/112105266
5. https://nptel.ac.in/courses/112105123
6. https://nptel.ac.in/courses/101104067

Course Code	**PCC-ME-203B**				
Category	Professional Core Courses				
Course Title	**Computer Aided Design & Manufacturing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To aware about the introduction of CAD/CAM, and CIM. • To learn the Modelling of different types of curves, surface and solid. • To know about the transformation of points and lines in CAD software. • To know the numerical control machines, FMS, GT & CAPP.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the basic concepts of CAD/CAM	L1: Remember
CO2	Describe CAD/CAM tools, modelling techniques, geometric transformations & process planning.	L2: Understand
CO3	Apply modelling and coding principles to CAD/CAM systems.	L3: Apply
CO4	Analyze integrated systems for productivity and automation.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**CAD/CAM:** Introduction, Design Process, Importance and Necessity of CAD, Applications of CAD, Hardware and Software requirement of CAD. **Computer Integrated Manufacturing:** Introduction, Components of CIM, CIM Architecture and Information Flow, CAD/CAM Integration in CIM, Advantages, Limitations and Applications of CIM.
Unit-II	**Curve Modelling**: Representation of curves, Parametric and non-parametric curves, straight lines, Hermite cubic splines, B splines curves, Bezier curves. **Surface & Solid Modelling:** Plane surface, ruled surface, surface of revolution, bi-cubic surface, Bezier surface, B spline surface, Solid modelling, boundary representation, sweeping, parametric solid modelling.
Unit-III	**Geometric Transformations:** Introduction, 2D & 3D Transformation, translation, rotation, Reflection, Scaling, shearing and combined transformation, Homogeneous coordinates. **Group Technology**: Introduction, Part families, Part classification and coding, Optiz method, product flow analysis, Machine cell Design, Advantages of GT.

Unit-IV	**Numerical control**: Types of NC systems, MCU & other components, Co-ordinate system, NC manual part programming, G & M codes, part program for simple parts, Computer assisted part programming. **FMS & CAPP:** Introduction, FMS component, Types of FMS, FMS layout, planning for FMS, advantage and applications of FMS, conventional process planning, Steps in variant process planning, types of CAPP, planning for CAPP

Suggested Readings:

1. CAD/CAM theory and Practice by Ibrahim Zeid, Tata McGraw Hill.
2. CAD/CAM Computer Aided Design and Manufacturing by E Zimmer M Groover, Pearson.
3. CAD/CAM/CIM by P. Radhakrishnan, New Age International Publishers.
4. Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell Groover, Pearson

Web References:

1. http://www.digimat.in/nptel/courses/video/112102101/L43.html
2. https://youtu.be/t7yv4gSnNkE?si=MbYZjlOhoRt-_4tg
3. https://youtu.be/_PlFbHuWFOI?si=idtfnZFN-INMjj-4
4. https://youtu.be/-J2m_ugWNtc?si=qvFki6d_3LjhAFR7
5. https://youtu.be/iWxS2zpaRjk?si=8SROYKLus9Q4PfVP
6. https://youtu.be/y3-5ENFtqrQ?si=nwZ4kWVP6fVusQmW
7. https://www.youtube.com/watch?v=3qd1JT7sRG8

Course Code	**PCC-ME-205B**				
Category	Professional Core Courses				
Course Title	**Materials and Metallurgy**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce to crystal structures, defects and their effects on properties. • To know the mechanical properties and materials testing techniques. • To learn the mechanisms of material failure including fracture, fatigue, and creep. • To gain the knowledge of phase diagrams and heat treatment processes. • To explore severe plastic deformation techniques for advanced applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts of materials and metallurgy.	L1: Remember
CO2	Explain the crystallography, defects, mechanical behaviour, phase transformations, heat treatments and advanced methods.	L2: Understand
CO3	Apply appropriate principles and method to enhance the material performance.	L3: Apply
CO4	Analyze the effects of internal structure, mechanical behaviour, and processing methods on material characteristics.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Crystallography**: Reviews of Crystal structure, Classification of Lattices - Bravais Lattice, Crystal planes, Crystal directions, Coordinate number, Atoms per unit cell, Atomic Packing Factor, Numerical related to crystallography. **Imperfection in Solids**: Point Defects; vacancy, substitutional, interstitial, Frenkel and Schottky defects; Line Defects; edge and screw dislocations, Planar Defects; grain boundaries and twin boundaries; Volume defects & effects of imperfections on metal properties.
Unit-II	**Mechanical Property Measurement:** Mechanical properties of materials, relation between true and engineering stress strain curves, generalized hook's law, yielding and yielding strength, hardness testing of materials, Tensile properties of the materials, Effect of strain rate, Impact Testing, Non-destructive testing (NDT). **Fracture of Metals** – Ductile Fracture, Brittle Fracture, Ductile to Brittle Transition Temperature (DBTT), Fatigue – Endurance limit, Fatigue test, factors affecting fatigue, structural changes accompanying fatigue; Creep and stress rupture– mechanism of creep – stages of creep and creep test, Mechanisms of Strengthening in Metals and alloys.

Unit-III	**Phase Diagrams and Transformations in Alloys**: Solid solutions and phase diagram; Introduction to single and multiphase solid solutions and types of solid solutions, importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves, unary & binary phase diagrams, Gibbs's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram.
Unit-IV	**Heat Treatment:** Principles of heat treatment, Annealing, Concept of Recovery, Recrystallization and Grain Growth, Normalizing, Hardening, Tempering, Quenching, Special heat treatment processes: Austempering, Martempering, Ausforming, Hardenability of steel, Microstructure changes during heat treatment. Surface hardening processes - Carburizing – Nitriding – Cyaniding and carbo-nitriding, Induction and flame hardening, Laser and Electron beam hardening. **Severe Plastic Deformation**: Introduction; its importance in producing ultrafine-grained materials; SPD techniques: Equal Channel Angular Pressing (ECAP), High Pressure Torsion (HPT), and Accumulative Roll Bonding (ARB); applications, and limitations of SPD-processed materials

Suggested Readings:

1. Material Science and Engineering-An Introduction - Callister; W.D., John Wiley & Sons. Delhi.
2. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpat Rai & Sons
3. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi.
4. Engineering Materials and Metallurgy - U. C. Jindal, Pearson.
5. Principles of Materials Science, W.F. Smith, McGraw Hill, 3rd Revised Edition, 1990.

Web References:

1. https://www.youtube.com/watch?v=OTDVov_kw6A
2. https://archive.nptel.ac.in/courses/113/104/113104081/
3. https://archive.nptel.ac.in/courses/113/105/113105106/
4. https://archive.nptel.ac.in/courses/113/104/113104068/
5. https://archive.nptel.ac.in/courses/113/104/113104074/
6. http://digimat.in/nptel/courses/video/113106105/L39.html

Course Code	**ESC-ME-207B**				
Category	Engineering Science Courses				
Course Title	**Engineering Mechanics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To know the fundamentals of mechanics. • To learn the concept of equilibrium of rigid bodies. • To find the C.G. & find M.I. of different geometrical figures. • To provide knowledge of simple machines and their applications. • To introduce to principles of kinematics &dynamics.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the basic terminologies and fundamentals of engineering mechanics.	L1: Remember
CO2	Describe the kinematics, dynamics, geometrical properties and simple machines.	L2: Understand
CO3	Apply the theorems and principles to solve the problems of engineering mechanics.	L3: Apply
CO4	Analyze the basic mechanical systems subjected to different loading conditions.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fundamentals:** Definitions of Mechanics, Statics, Dynamics, Rigid Bodies, Force System, Resolution of Force. Analytical and graphical method for resultant of force, Moment of Force. Varignon's Theorem, Numerical Problems. **Equilibrium:** Definition, condition of equilibrium, types of equilibrium - stable equilibrium, unstable equilibrium, neutral equilibrium, free body diagram, method of equilibrium of coplanar forces – analytical method, graphical method, Lami's Theorem, Numerical Problems.
Unit-II	**Truss and Frames:** Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Numerical Problems. **Centroid:** Centroid – Definition, Moment of an area about an axis, centroid of geometrical figures such as squares, rectangles, triangles, circles, semicircles & quarter circles, centroid of composite figures, Numerical Problems.
Unit-III	**Moment of Inertia:** Definition, Parallel axis & Perpendicular axis Theorems. M.I. of plane lamina & different engineering sections, Numerical Problems. **Kinematics**: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, Numerical Problems.

Unit-IV	**Dynamics:** Newton's Laws of Motion, Motion of Particle acted upon by a constant force, Equations of motion, DE Alembert's Principle, Work, Power, Energy- Kinetic & Potential energy, Momentum & impulse, Laws of conservation of energy & linear momentum, collision of elastic bodies, Numerical Problems. **Simple Machines:** Definition of simple machine, explain simple & compound lifting machine, define M.A, V.R. & Efficiency, State Law of Machine, Reversibility of Machine, Self-Locking Machine. Study of simple machines – simple axle & wheel, single purchase winch crab& double purchase winch crab, Worm & Worm Wheel, Screw Jack, Types of hoisting machine.

Suggested Readings:

1. Text Book of Engineering Mechanics – R.S Khurmi (S. Chand).
2. Engineering Mechanics by Timoshenko S, and Young D.H, Tata McGraw Hill.
3. Engineering Mechanics – Static and Dynamics by Shames I.H, and Rao G.K.M, Pearson Education.
4. Vector Mechanics for Engineers by Beer F.P and Johnson Jr. E.R, Tata McGraw Hill.
5. Engineering Mechanics –Statics & Dynamics, R. C. Hibbeler, 11th Ed., Macmillan Publication Co.

Web References:

1. https://nptel.ac.in/courses/112103108
2. https://nptel.ac.in/courses/112106180
3. https://nptel.ac.in/courses/112106286
4. https://nptel.ac.in/courses/112104526
5. https://nptel.ac.in/courses/112103108

Course Code	**BSC-ME-209B**				
Category	Basic Science Courses				
Course Title	**Mathematics-III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are to make the students • To provide an overview of PDE, Probability and Statistics to engineers. • To introduce the solution methodologies for PDE, Probability and Statistics with Applications in engineering.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall fundamental concepts and principles of differential equations, probability & statistics.	L1: Remember
CO2	Describe basic concepts of probability, statistics & partial differential equations.	L2: Understand
CO3	Apply the various methods and techniques to solve engineering problems.	L3: Apply
CO4	Analyze the different patterns and behaviour of statistics, probability & partial differential equations.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second- order linear equations and their classification, Initial and boundary conditions, D' Alembert's solution of the wave equation.
Unit-II	Duhamel's principle for one-dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One-dimensional diffusion equation and its solution by separation of variables.
Unit-III	Measures of central tendency, Moments, Skewness and Kurtosis, Basic concepts of Probability, Conditional probability, Baye's theorem, Random variables, Discrete random variables, Expectation of discrete random variables, Variance of a sum, Binomial distribution, Poisson distribution, Continuous random variables and their properties, Distribution functions, Normal Distribution.
Unit-IV	Testing of hypothesis, Test of significance, large sample test for single proportion, Difference of proportions, Tests for single mean, Difference of means and Difference of standard deviations, Test for ratio of variances, Chi-square test for goodness of fit and Independence of attributes.

Suggested Readings:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited
3. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications
4. Business Statistics by T.R. Jain and S.C. Aggarwal, VK Global Publications Pvt. Ltd.
5. S. Ross, A First Course in Probability,6th Ed., Pearson Education India.

Web References:

1. https://www.youtube.com/watch?v=KlZqe4UC1jk
2. https://www.youtube.com/watch?v=5eZbgxmpK3Q&t=520s
3. https://www.youtube.com/watch?v=PVUfuiuWaZQ
4. https://youtu.be/qu2kuCFCqbM?si=kcSK59hh5XoQrRdA
5. https://www.youtube.com/watch?v=DgvQzfLpaTY&t=92s
6. https://youtu.be/1wxhLYiHFaE?si=GApUpW3_VTOD8q-b
7. https://youtu.be/60vHy2lA4o4
8. https://youtu.be/Sv9UYnp9tbs?si=eHqwSJETA5SO3NFI
9. https://youtu.be/o2LB3KQME3U?si=NWaP0TY_K8tPaAfu
10. https://youtu.be/14PQawp_rjk
11. https://auece.digimat.in/nptel/courses/video/111105090/L72.html
12. https://youtu.be/SlCsNb-VXds?feature=shared

Course Code	**HSMC-01B**				
Category	Humanities and Social Science including Management Courses				
Course Title	**Fundamental of Management and Organizational Behaviour**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are • Introduce students to foundational management theories, functions, and organizational concepts to build a strong conceptual framework. • Develop understanding of individual and group behaviour, motivation, communication, and leadership in organizational settings. • Equip students with practical skills to manage interpersonal processes, conflicts, and team dynamics effectively. • Foster critical analysis of organizational structures, cultures, and change mechanisms to enhance adaptability and effectiveness in organizations.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental management concepts, functions, organizational processes, and organizational behaviour elements.	L1: Remember
CO2	Explain the roles, skills, and interrelationships in management, individual behaviour, group dynamics, and communication processes within organizations.	L2: Understand
CO3	Apply principles of management, motivation techniques, leadership styles, and conflict management strategies to solve organizational behaviour challenges.	L3: Apply
CO4	Analyze organizational structure, culture, change processes, and behavioral dynamics to support effective decision-making and organizational development.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction of Management:** Meaning, Definitions, Nature of Management; Managerial Levels, Skills and Roles in an Organization. **Functions of Management:** Planning, Organizing, Staffing, Directing & Controlling, Interrelationship of Managerial Functions, Scope of Management, Importance of Management, Difference between Management and Administration.
Unit-II	**Introduction of Organization:** Meaning and Process of Organization, Management v/s Organization. **Fundamentals of Organizational Behaviour:** Concepts, Evolution, Importance and Relationship with other Fields, Contemporary Challenges and Opportunities of OB**.** **Individual Processes and Behaviour:** Personality, Concept, Determinants and Applications. **Perception:** Concept, Process and Applications **Learning:** Brief Introduction **Motivation:** Concept, Techniques and Importance

Unit-III	**Interpersonal Processes**: Teams and Groups, Definition of Group, Stages of Group Development, Types of Groups, Meaning of Team, Merits and Demerits of Team, Difference between Team and Group, Conflict- Concept, Sources, Types, Management of Conflict. **Leadership:** Concept, Function, Styles, Qualities of Leadership. **Communication**: Meaning, Process, Channels of Communication, Importance and Barriers of Communication.
Unit-IV	**Organizational Processes:** Organizational Structure, Meaning and Types of Organizational Structure and their effect on Human Behaviour. **Organizational Culture**: Elements, Types and Factors affecting Organizational Culture. **Organizational Change:** Concept, Types and Factors affecting Organizational Change, Resistance to Change.

Suggested Readings:

1. Fundamentals of Management by Robbins, S.P. and Decenzo, Pearson Education, New Delhi.
2. Organizational Behaviour by Robbins, S.P. & Judge, T.A., Prentice Hall of India, New Delhi.
3. Management concept practice and cases by Ghuman Karminder, Aswathappa K., Tata McGraw Hill, New Delhi
4. Fundamental of Management by Chhabra T. N., Sun India Publications, New Delhi.
5. Organizational Behaviour by Stephen P Robin, Pearson Education.
6. Organizational Behaviour by McShane, Steven L, Tata McGraw Hill, New Delhi.
7. Organizational Behaviour by FC Sharma, Shree Mahavir Publications.

Web References:

1. https://nptel.ac.in/courses/110105146
2. https://nptel.ac.in/courses/110103433
3. https://archive.nptel.ac.in/courses/110/106/110106145/
4. https://nptel.ac.in/courses/110105146

Course Code	**MC-201B**				
Category	Mandatory Courses				
Course Title	**Environmental Science**				
Scheme and Credits	L	T	P	**Credits**	**Semester- III**
	2	0	0	-	
Course Objectives	The objectives of this course are • To create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources. • To develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health. • To foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society. • To engage students in practical learning through field work and case studies to apply environmental concepts for sustainable development and responsible citizenship.				
Assessment	20 Marks				
End Semester Examination	30 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

CO	**Skill Demonstrated**	**RBT Level**
CO1	Describe key terminologies of environmental studies, natural resources, ecosystems, pollution, environmental laws and human-environment interactions.	L1: Remember
CO2	Explain the relationships among ecosystems, biodiversity, pollution, social issues, environmental ethics and related legislation for sustainable development.	L2: Understand
CO3	Apply principles of environmental management, pollution control, disaster management and sustainable practices in real world environmental contexts.	L3: Apply
CO4	Analyze environmental issues, population growth impacts, climate change, welfare programs and the role of information technology in promoting public health and environmental sustainability.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts (Covering all units) of 1.5 marks each and remaining eight questions of 6 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance.
Natural Resources: Renewable and Non-Renewable Resources; Natural Resources and Associated Problems.
(a) Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies, Timber Extraction, Mining, Dams and their effects on Forests and Tribal People.
(b) Water Resources: Use and Over-Utilization of Surface and Groundwater, Floods, Drought, Conflicts Over Water, Dams—Benefits and Problems.
(c) Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies.

(d) Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer and Pesticide Problems, Waterlogging, Salinity, Case Studies.
(e) Energy Resources: Growing Energy Needs, Renewable and Non-Renewable Energy Sources, Use of Alternate Energy Sources, Case Studies.
(f) Land Resources: Land as a resource, Land Degradation, Man-Induced Landslides, Soil Erosion and Desertification.
Role of an Individual in Conservation of Natural Resources, Equitable Use of Resources for Sustainable Lifestyles.

Unit-II

Ecosystems: Producers, Consumers and Decomposers, Energy Flow in the Ecosystem, Ecological Succession, Food Chains, Food Webs and Ecological Pyramids—Introduction, Types, Characteristic Features, Structure and Function of Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem and Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans and Estuaries).
Biodiversity and Its Conservation: Introduction, Definition, Genetic Diversity, Species Diversity and Ecosystem Diversity. Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation, Hotspots of Biodiversity.
Values of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values.
Threats to Biodiversity: Habitat Loss, Poaching of Wildlife and Man–Wildlife Conflicts, Endangered and Endemic Species of India.
Conservation of Biodiversity: In-situ and Ex-situ Conservation.

Unit-III

Environmental Pollution: Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution and Nuclear Hazards.
Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies.
Disaster Management: Floods, Earthquakes, Cyclones and Landslides.
Social Issues and the Environment: From Unsustainable to Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rainwater Harvesting, Watershed Management, Resettlement and Rehabilitation of People, Problems and Concerns, Case Studies.
Environmental Ethics: Issues and Possible Solutions, Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies, Wasteland Reclamation, Consumerism and Waste Products.
Environmental Legislation: Environment Protection Act, Air Prevention and Control of Pollution Act, Water Prevention and Control of Pollution Act, Wildlife Protection Act, Forest Conservation Act, Issues Involved in Enforcement of Environmental Legislation, Public Awareness.

Unit-IV

Human Population and the Environment: Population Growth, Variation among Nations, Population Explosion, Family Welfare Programme, Environment and Human Health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies.
Field Work *(Equivalent to 10 Lecture Hours)*

- Visit to a Local Area to Document Environmental Assets—River, Forest, Grassland, Hill or Mountain.
- Visit to a Local Polluted Site—Urban, Rural, Industrial or Agricultural.
- Study of Common Plants, Insects and Birds.
- Study of Simple Ecosystems—Pond, River, Hills, Slopes, etc.

Suggested Readings:

- Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner

- The Biodiversity of India by Bharucha, MAP in Publishing Pvt.Ltd., Ahmedabad.
- Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc.,1989
- Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
- Global Biodiversity Assessment by V.H. Heywood & R.T.Watson, Cambridge University Press, 1995, 1140p.
- Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House, Delhi, 1995, 284p.
- Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
- Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd., 1987, 345p.
- Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut, 2001.
- Survey of the Environment, The Hindu.
- Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
- Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
- Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA, 1998, 499p.
- A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
Unit-II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
Unit-III	Sustainable Water Management in Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

Course code	**LC-ME-211B**				
Category	Professional Core Courses				
Course title	**Materials & Metallurgy Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are • To study crystallography and imperfections in materials through models. • To learn how to prepare specimen for microstructure analysis. • To familiarise with heat treatment processes and their effects om materials properties and microstructure. • To enhance the skills in using microscopy and other testing equipment's.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the crystallography, imperfections, and the working principles of metallurgical equipment's.	L2: Understand
CO2	Apply specimen preparation and etching techniques for metallographic examination of metals.	L3: Apply
CO3	Analyze the effect of heat treatment processes on material properties & microstructure.	L4: Analyze
CO4	Analyze the microstructures of different nonferrous materials.	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study various crystal structures through ball models.	**CO1**
2	To study of crystal imperfections through ball models.	**CO1**
3	To study the components and functions of metallurgical microscope.	**CO1**
4	To study of Muffle furnace and policing machine.	**CO1**
5	To study modern characterization (microscopy) techniques.	**CO1**
6	To prepare chemical etchant for ferrous and non-ferrous alloys.	**CO2**
7	To prepare a specimen for metallographic examination.	**CO2**
8	To analyze the changes in hardness of steel / iron after heat treatment processes.	**CO3**
9	To analyze the changes in microstructure of steel / iron after annealing.	**CO3**
10	To analyze the changes in microstructure of steel / iron after normalizing.	**CO3**

11	To analyze the changes in microstructure of steel / iron after quenching.	**CO3**
12	To analyze the microstructure of non-ferrous metal (Aluminum).	**CO4**
13	To analyze the microstructure of non-ferrous metal (Copper).	**CO4**
14	To analyze the microstructure of non-ferrous metal (Brass).	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web References:

1. https://mrmsmtbs-iitk.vlabs.ac.in/exp/nucleus-cellsproliferation/simulation.html
2. https://mrmsmtbs-iitk.vlabs.ac.in/exp/hardness-modulus/simulation.html
3. https://www.youtube.com/watch?v=OTDVov_kw6A
4. https://archive.nptel.ac.in/courses/113/105/113105101/

Course code	**LC-ME-213B**				
Category	Professional Core Courses				
Course title	**Computer Aided Design & Manufacturing Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are • To introduce students to the fundamentals and key features of CAD software used for part modelling and assembly design. • To provide hands-on experience in generating 3D models, part drawings, and assemblies using modern CAD tools. • To familiarize students with CNC programming for basic machining operations. • To expose students to classification systems and emerging technologies in manufacturing.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the essential features and tools of CAD software and NC programming.	L2: Understand
CO2	Use drawing and modification tools to create 2D sketches and part models.	L3: Apply
CO3	Use CAD software for 3D models and assembly of mechanical components.	L3: Apply
CO4	Use G & M codes to write NC part programs for manufacturing operations.	L3: Apply

List of Experiments

Sr. No.	Content	COs
1	To Introduction to the different features of CAD software's.	**CO1**
2	To Work with the draw and modify tools like pattern, copy, rotate, move, mirror etc.	**CO2**
3	To Draw the 2D part drawing of product 1 using software.	**CO2**
4	To Draw the 2D part drawing of product 2 using software.	**CO2**
5	To Work with creating 3D features like extrude revolve etc.	**CO3**
6	To Work with tools like hole, round, chamfer etc.	**CO3**
7	To Draw 3D models by extruding simple 2D objects.	**CO3**
8	To make an assembly drawing using different parts.	**CO3**
9	To study the G codes and M codes.	**CO1**
10	To Write a NC program for milling operation.	**CO4**
11	To Write a NC program for drilling operation.	**CO4**

12	To Write a NC program for turning operation	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web References:

1. https://youtu.be/UvP3fSGye-Y
2. https://youtu.be/ImtSsDLgAaI
3. https://youtu.be/B7MM5M7DzpM?si=SxDdSNolcFlwN4A9
4. https://youtu.be/_5r2XR1h1aQ

Course code	**LC-ME-215B**				
Category	Basic Science Courses				
Course title	**Engineering Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand force laws using triangle law, polygon law, and parallel force experiments. ● To learn how to calculate mechanical advantage, velocity ratio, and efficiency of simple machines. ● To study the moment of inertia using a flywheel. ● To measure the deflections in a pin-jointed truss.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Determine the forces in members by applying laws of forces.	L3: Apply
CO2	Calculate mechanical advantage, velocity ratio, and efficiency of lifting devices.	L3: Apply
CO3	Analyze the internal forces and deflections in various structural elements.	L4: Analyze
CO4	Evaluate the moment of inertia and verify beam deflection principles including reciprocal and parallel force theorems.	L5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To determine the resultant force by applying law of polygon of forces.	**CO1**
2	To determine the resultant force by applying law of triangle of forces.	**CO1**
3	To calculate the mechanical advantage, velocity ratio and Mechanical efficiency of winch crab.	**CO1**
4	To calculate the mechanical advantage, velocity ratio and mechanical efficiency of a screw jack.	**CO2**
5	To calculate the mechanical advantage, velocity ratio and mechanical efficiency of single start worm and worm wheel.	**CO2**
6	To calculate the mechanical advantage, velocity ratio and mechanical efficiency of double & triple start worm and worm wheel.	**CO2**
7	To analyse the internal forces acting on various members of a jib crane using experimental methods.	**CO2**
8	To analyse the horizontal and vertical deflections at various joints of a pin-jointed truss using experimental data.	**CO3**
9	To analyse the behaviour of a 3-bar pin-jointed truss by comparing experimental results with analytical calculations.	**CO3**
10	To evaluate the moment of inertia of a given fly-wheel.	**CO4**

11	To verify the reciprocal theorem of deflection using a simply supported beam.	**CO4**
12	To verify the principle of forces in beam of parallel forces apparatus.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web References:

1. http://phy-sc22-au.vlabs.ac.in/mechanics/Moment_of_Inertia_of_Flywheel/
2. https://virtual-labs.github.io/exp-trusses-iiith/index.html
3. https://amrita.olabs.edu.in/?sub=1&brch=5&sim=20&cnt=4

Course Code	**PCC-ME-202B**				
Category	Professional Core Courses				
Course Title	**Applied Thermodynamics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To learn about dynamics involved in thermal energy transformation. • To know thermal system components for improving efficiency and effectiveness. • To provide a knowledge of steam generation systems, fuels, and combustion processes used in power generation. • To introduce about gas and vapour power cycles.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts of steam generation, fuels, power cycles, and related equipment.	L1: Remember
CO2	Describe principles and functions involved in thermodynamic cycles and devices.	L2: Understand
CO3	Apply thermodynamic principles and equations to solve energy and flow problems.	L3: Apply
CO4	Analyze the effects of operating parameters on the performance of thermal systems and machinery.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Steam Generators**: Introduction, classification of boilers, comparison of fire tube and water tube boilers, description of boilers; Lancashire, Babcock Wilcox, Cochran etc. boiler's mountings and accessories, design of natural draught chimney, artificial draught, mechanical draught, efficiency of boiler and heat balance. **Fuel and Combustion:** Classification of fuels – solid, liquid and gaseous fuels, calorific values of fuels, bomb calorimeter and analyse of combustion product, stoichiometric air fuel ratio, excess air requirement, efficiency of boiler and heat balance. Problems.
Unit-II	**Vapor power cycles:** Carnot vapour power cycle, Simple and modified Rankine cycle, p-v, h-s and T-s diagram for Rankine and Modified Rankine Cycle, effect of operating parameters on Rankine cycle performance. Effect of maximum pressure, effect of exhaust pressure, reheating and regenerative Rankine cycle. **Gas power cycles:** Air standard Otto, Diesel and Dual Cycles-Air standard Brayton cycle, effect of reheat, regeneration and inter cooling- Combined gas and vapor power cycles. Problems

Unit-III	**Steam Nozzles**: Function of steam nozzles, shape of nozzles for subsonic and supersonic flow of steam, steady state energy equation, continuity equation, nozzle efficiency, critical pressure ratio for max. discharge, design of steam nozzle, problems. **Steam Condensers**: Classification of condensers, sources of air leakage in condensers, effect of air leakage in condenser, vacuum efficiency, condenser efficiency, air pumps, calculation of cooling water requirement, and problem.
Unit-IV	**Reciprocating compressors:** Staging of reciprocating compressors, optimal stage pressure ratio, effect of inter cooling, isothermal efficiency, volumetric efficiency, minimum work for multistage reciprocating compressors. Problems. **Steam Turbine:** Classification of steam turbine, impulse turbine, working principle, compounding of impulse turbine, velocity diagram, power output and efficiency of a single stage impulse turbine, reaction turbine, working principle, degree of reaction, velocity diagram, power output, efficiency, condition for max. Efficiency, governing of steam turbines, problem.

Suggested Readings

1. Engineering Thermodynamics - Nag, P.K, Tata McGraw-Hill Publishing Co. Ltd
2. Thermal Engineering - P.L. Ballaney Khanna Publisher.
3. Engineering Thermodynamics - Jones, J. B. and Duggan, R. E., Prentice Hall of India.
4. Thermodynamics and Heat Engines Vol II - R. Yadav, Central Publishing House.
5. I.C. Engines - M.L. Mathur and Sharma Dhanpat Rai & Sons.
6. Thermodynamics- An Engineering Approach, Y. Cengel and M. Boles, McGraw Hill Education; Eighth Edition, 2017

Web References:

1. https://youtu.be/fscJadXHhTU?feature=shared
2. https://youtu.be/4-BI22Wx4Pc?feature=shared
3. https://youtu.be/G02aeguJBwc?feature=shared
4. https://youtu.be/t-Kucwi3SDI?feature=shared
5. https://nptel.ac.in/courses/112103307
6. https://nptel.ac.in/courses/112107291
7. https://nptel.ac.in/courses/112103421

Course Code	**PCC-ME-204B**				
Category	Professional Core Courses				
Course Title	**Strength of Materials**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To familiarize with stress, strain and deformation of solids under different loading conditions. • To equip students with ability to think critically and solve problems related to the strength and stability of structures. • To learn how materials, behave under different types of forces and conditions. • To develop an ability to analyse the real engineering problems and design engineering systems.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts of strength of materials.	L1: Remember
CO2	Explain the expression and behaviour of structural elements under various loading and support conditions.	L2: Understand
CO3	Solve problems related to internal forces, stresses, and deformations in structural members.	L3: Apply
CO4	Analyze the structural components for performance under different loading conditions.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Stress & Strain:** Concept & types of Stresses and Strains, Poisson's ratio, Hooks law, Stress Strain diagrams, stresses and strains in simple and compound bars under axial loading, elastic constants & their relationships, temperature stresses and strains in simple and compound bars under axial loading, Problems. **Principle Stresses& Strains:** Two-dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stresses, Problems.
Unit-II	**Shear Force & Bending Moment:** Definitions, Beams and types transverse loading on beams, types of beam support, SF& BM diagram for cantilevers, simply supported and over-hanging beams, calculation of maximum BM & SF and Point of contra flexure, Problems. **Bending & Shear Stresses in Beams:** Bending stresses in Beam, Theory of bending of beams, bending stress distribution and neutral axis, shear stresses in beam, shear stress distribution Problems.

Unit-III	**Torsion of Circular Members:** Torsion, stresses and deformation in circular solid and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, Problems. **Columns & Struts:** Introduction**,** Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Euler's, Rankine, Gordon's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Problems.
Unit-IV	**Slope & Deflection:** Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, uniformly distributed loads or combination of concentrated & uniformly distributed loads and Maxwell's reciprocal theorem, Problems.

Suggested Readings:

1. Strength of Materials – G.H. Ryder - Macmillan, India.
2. Strength of materials, RK Bansal, Laxmi Publication.
3. Engineering Mechanics of Solids - EGOR. P. POPOV, Prentice Hall of India.
4. Strength of Materials - R. Subramanian, Oxford University Press.
5. Mechanics of Materials, F.P. Beer, E.R. Johnston (Jr.) and J.T. DeWolf, Tata McGraw Hill

Web References:

1. https://nptel.ac.in/courses/112106319
2. https://youtu.be/vC8h1RFKYs?feature=shared
3. https://nptel.ac.in/courses/112107147
4. https://youtu.be/sP34uzn7diA?feature=shared
5. https://youtu.be/ZSQ_5lRj5gI?feature=shared
6. https://youtu.be/IQB0bJRCRxo?feature=shared
7. https://nptel.ac.in/courses/105105108

Course Code	**PCC-ME-206B**				
Category	Professional Core Courses				
Course Title	**Fluid Mechanics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts and properties of fluids. • To learn the fluid behavior under various flow conditions. • To learn applications involving compressible flow, viscous effects, boundary layers, and turbulence. • To understand flow measurement devices and solve problems pertaining to flow through pipes.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts and basics of fluid mechanics.	L1: Remember
CO2	Explain the fluid properties &principles governing fluid motion and behavior.	L2: Understand
CO3	Apply fluid mechanics laws and equations to solve flow problems.	L3: Apply
CO4	Analyze performance characteristics and behavior of fluid under various conditions.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fluid Properties and Fluid Statics**: Concept of fluid and flow, properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium, Problems. **Fluid Kinematics:** Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net, Problems.
Unit-II	**Fluid Dynamics:** Concept of system and control volume, Euler's equation, Bernoulli's equation, venturi meter, orifices, orifice meter, mouthpieces, kinetic and momentum correction factors, Impulse momentum relationship and its applications, Problems. **Compressible Fluid Flow:** Introduction, continuity momentum and energy equation, sonic velocity, propagation of elastic waves due to compression of fluid, propagation of elastic waves due to disturbance in fluid, stagnation properties, isentropic flow, effect of area variation on flow properties, isentropic flow through nozzles, diffusers, injectors, Problems.

Unit-III	**Viscous Flow:** Flow regimes and Reynolds's number, Relationship between shear stress and pressure gradient, Hagen-Poiseuilli law, uni-directional flow between stationary plates, movement of piston in a dashpot, power absorbed in bearings. Problems. **Flow Through Pipes:** Major and minor losses in pipes, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes, Problems.
Unit-IV	**Boundary Layer Flow:** Boundary layer concept, displacement, momentum and energy thickness, Von-Karman momentum integral equation, laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control. Streamlined and bluff bodies lift and drag on a cylinder and an airfoil, Problems. **Turbulent Flow:** Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes, Problems.

Suggested Readings

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons.
2. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill.
3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH.
4. Mechanics of Fluids – I H Shames, Mc Graw Hill.
5. Fluid Mechanics – Streeter, Wylie and Bedford, TMH.

Web References:

1. https://youtu.be/mKROgeUc_Ow?feature=shared
2. https://youtu.be/H38vI93exns?feature=shared
3. https://youtu.be/nftfzCxQKfk?feature=shared
4. https://youtu.be/cVmK3dLeCZ4?feature=shared
5. https://youtu.be/p7-oAAAszHc?feature=shared
6. https://youtu.be/CzrQxXK0CKk?feature=shared
7. https://youtu.be/zw2F4utGoVQ?feature=shared
8. https://youtu.be/OsCTaeh_rBc?feature=shared

Course Code	**PCC-ME-208B**				
Category	Professional Core Courses				
Course Title	**Kinematics of Machines**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To learn the fundamentals of mechanisms and motion transmission. • To develop students for generation of cam profile • To equip students with tools for kinematic analysis and synthesis. • To know the friction and belt drive systems used in machines.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the basic terminologies related to kinematics of machines.	L1: Remember
CO2	Explain the principles of kinematics, motion and function of mechanical systems and components.	L2: Understand
CO3	Apply graphical and analytical methods to solve the kinematics related problems.	L3: Apply
CO4	Analyze the performance and motion characteristics of mechanisms and power transmission systems.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction**: Mechanism and machines, kinematics links, kinematics pairs, kinematics chains, degree of freedom, Grumbler's rule, kinematics inversion, equivalent linkages, four link planar mechanisms, straight line mechanisms, steering mechanisms, pantograph, problems. **Kinematics Analysis of Plane Mechanisms:** displacement analysis, velocity diagram, velocity determination, relative velocity method, instantaneous center of velocity, Kennedy's theorem, graphical and analytical methods of velocity and acceleration analysis, problems.
Unit-II	**Cams:** Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, analysis of follower motions, determination of basic dimension, synthesis of cam profile by graphical methods, cams with specified contours, problems. **Gears: F**undamental law of gearing, involute spur gears, characteristics of involute and cycloidal action, interference and undercutting, center distance variation, path of contact, arc of contact, non-standard gear teeth, helical, spiral bevel and worm gears, problems.

Unit-III	**Gear Trains**: Synthesis of simple, compound and reverted gear trains, analysis of epicyclic gear trains, problems. **Kinematics synthesis of Mechanisms:** Function generation, path generation, Freudenstein's equation, two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods, precision positions, structural error; Chebychev spacing, transmission angle, problems.
Unit-IV	**Friction**: Types of friction, laws of friction, motion along inclined plane, screw threads, efficiency on inclined plane, friction in journal bearing, friction circle and friction axis, pivots and collar friction, uniform pressure and uniform wear. **Belts and pulleys**: Open and cross belt drive, velocity ratio, slip, material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts, ratio of tension, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drives, chain length, classification of chains.

Suggested Readings:

1. Theory and Machines - S.S. Rattan, Tata McGraw Hill.
2. Theory of Machines - Bevan, Pearson Indian Education Service Pvt. Ltd. India.
3. Mechanism and Machine Theory - J.S. Rao and R.V. Dukkipati, New Age International.
4. Theory of Mechanisms and Machines - Amitabha Ghosh and Ashok Kumar Malik, East-West Press.
5. Theory of Machines and Mechanisms, J. J. Uicker, G. R. Pennock, J. E. Shigley, Oxford Education, Fourth Edition, 2011.

Web References:

1. https://archive.nptel.ac.in/courses/112/104/112104121/
2. https://archive.nptel.ac.in/courses/112/106/112106270/#
3. https://archive.nptel.ac.in/courses/112/105/112105268/
4. https://nptel.ac.in/courses/112103108
5. https://nptel.ac.in/courses/112106286
6. https://nptel.ac.in/courses/112105124

Course Code	**PCC-ME-210B**				
Category	Professional Core Courses				
Course Title	**Manufacturing Technology -I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To know how cutting tools work, how chips are formed, and what affects the life of a cutting tool. • To learn how to calculate machining costs and choose the best cutting conditions to save time and money. • To know how jigs and fixtures help in holding work-pieces and how measuring tools are used to check sizes and surface finish. • To understand how gears are made, how machines are specified, and how milling and drilling operations are done.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts of Manufacturing Technology.	L1: Remember
CO2	Explain principles of cutting, forming, metrology, and machine tools.	L2: Understand
CO3	Apply suitable tools, conditions, and setups for machining operations.	L3: Apply
CO4	Analyze the effects of process parameters and tool specifications on performance.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Metal Cutting & Tool Life:** Introduction, basic tool geometry, single point tool nomenclature, chips types and their characteristics, mechanics of chips formation, theoretical and experimental determination of shear angle, orthogonal and oblique metal cutting, relationship of velocity, forces, and power consumption, cutting speed, feed and depth of cut, coolant, temperature profile in cutting, tool life relationship, tailor equation of tool life, tool material and mechanism. **Economics of Metal Machining:** Cost considerations in manufacturing, elements of machining cost, minimum cost per piece, maximum production rate, optimum cutting speed and optimum tool life for minimum cost of production and maximum production rate.
Unit-II	**Jigs and Fixtures:** Introduction to jigs and fixtures, principles of locations, locating and clamping devices, jigs bushes, drilling jigs, milling fixtures, turning fixtures, boring and broaching fixtures, welding fixtures, different materials for jigs and fixtures. **Metrology:** Measurement, linear and angular simple measuring instruments, various clampers, screw gauge, sine bar, auto-collimator, comparator- mechanical, electrical, optical, surface finish and its measurements, micro and macro deviation, factors influencing surface finish and evaluation of surface finish.

Unit-III	**Gear manufacturing and finishing:** Introduction, Classification of gear production method, Gear generation processes: gear hobbing, gear shaping, Gear finishing methods: shaving, roll finishing, burnishing, grinding, lapping, honing. **Specification of Machine Tools:** Introduction, purpose of machine tool specifications, Methods of specification of conventional machine tools: specification of lathes, specification of drilling and boring machines, specification of shaper, planer and slotter machines, specification of milling machine, specification of gear teeth generating machines, specification of grinding machines.
Unit-IV	**Milling Process:** Milling Machine Operations performed on Milling machine, Parts of Milling Machine, Types of Milling machines- Column and Knee Type Milling Machines, fundamentals of Milling process, Milling Cutters, Elements of Plain Milling cutter, Cutter Holing devices, Indexing, Methods of Indexing. **Drilling Machine:** Construction of twist drill, Parts of twist drill, Drilling machine Types Radial drilling machine, Gang drilling machine, Drilling machine operations, Main parts of drilling machine, cutting speed, Feed and Depth of cut in drilling, MRR in drilling.

Suggested Readings:

1. Manufacturing Engineering Technology, K. Jain, Pearson Education
2. Principles of Manufacturing Materials and Processes, James S. Campbell, TMH.
3. Production Engineering Sciences by P.C. Pandey and C.K. Singh, Standard Publishers Ltd.
4. Manufacturing Science by A. Ghosh and A.K. Mallik, Wiley Eastern

Web references:

1. https://youtu.be/-R-fySRLa9Q?si=rjouuxiO4PYAi8VL
2. https://www.youtube.com/watch?v=YDSdhiMksoQ
3. https://www.youtube.com/watch?v=7yzvno4AvKw
4. https://www.youtube.com/watch?v=HpIEeBtJupY
5. https://www.youtube.com/watch?v=B8w-0Oi0Yf4
6. https://archive.nptel.ac.in/courses/112/105/112105233/
7. https://youtu.be/Rf90Jbbcr3M?si=3oMLtK3cYdBA1koj
8. https://www.youtube.com/watch?v=a07gtJbK9aU

Course code	**LC-ME-222B**				
Category	Professional Core Courses				
Course title	**Applied Thermodynamics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To introduce students to the fundamental principles and operational features of thermal equipment. ● To enable students to gain practical knowledge in analysing and evaluating the performance of thermal systems. ● To provide hands-on experience in conducting experiments related to steam generation, heat transfer, and power generation systems.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the construction details of various types of boilers, mountings and accessories.	L2: Understand
CO2	Demonstrate the working principle of various thermal equipment's.	L3: Apply
CO3	Analyze the thermodynamic properties of steam and system performance.	L4: Analyze
CO4	Evaluate the performance of reciprocating air compressor and cooling tower.	L5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To study low pressure boilers and their accessories and mountings.	**CO1**
2	To study high pressure boilers and their accessories and mountings.	**CO1**
3	To study the working of impulse and reaction steam turbines.	**CO2**
4	To study principle, construction and working of Bomb Calorimeter.	**CO2**
4	To study of heat balance sheet for given boiler.	**CO2**
5	To find power output & efficiency of a steam turbine.	**CO3**
6	To find dryness fraction of steam by separating and throttling calorimeter.	**CO3**
7	To find the condenser efficiencies.	**CO3**
8	To evaluate the volumetric efficiency of a reciprocating air compressor.	**CO4**
9	To study cooling tower and evaluate its efficiency.	**CO4**
10	To evaluate the isothermal efficiency of a reciprocating air compressor.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web References:

1. https://vmtitg.vlabs.ac.in/Separating_and_Throttling_Calorimeter(theory).html
2. https://vmt-iitg.vlabs.ac.in/Water_cooling_tower(procedure).html
3. https://www.youtube.com/watch?v=AQEQl8qJgfI
4. https://www.youtube.com/watch?v=S1pDhYR7ZQg

Course code	**LC-ME-224B**				
Category	Professional Core Courses				
Course title	**Strength of Materials Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To learn the working principles of various material testing machines and perform tests. ● To enhance the knowledge stress, strain of materials and ability to interpret the data from the experiments. ● To evaluate the mechanical properties of materials through impact, tensile, compression, bending, and shear tests.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Apply hardness testing procedures to determine the hardness of various engineering materials.	L3: Apply
CO2	Use appropriate methods to determine material behaviour under sudden impact & sheet deformation.	L3: Apply
CO3	Analyze the behaviour of materials under different types of loading.	L4: Analyze
CO4	Evaluate torsional, spring, and fatigue behaviour of materials using theoretical relationships.	L5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To determine the hardness of the given specimen using Brinell hardness test.	**CO1**
2	To determine the hardness of the given Specimen using Rockwell hardness test.	**CO1**
3	To determine the hardness of the given Specimen using Vickers hardness test.	**CO1**
4	To conduct sheet metal test in Erichsen sheet metal testing machine.	**CO2**
5	To determine the Impact strength of a given specimen using Izod impact test.	**CO2**
6	To determine the Impact strength of a given specimen using Charpy impact test	**CO2**
7	To perform tensile test on UTM.	**CO3**
8	To perform compression test on UTM.	**CO3**
9	To perform bending tests on UTM.	**CO3**
10	To perform the shear test on UTM.	**CO3**
11	To evaluate the torsional properties of mild steel using a torsion testing machine.	**CO4**

12	To evaluate the stiffness of a spring and the modulus of rigidity of its wire.	**CO4**
13	To evaluate a material's response to cyclic loading with a fatigue test machine.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web References:

1. https://sm-nitk.vlabs.ac.in/exp/brinell-hardness-test/
2. https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test/
3. https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test/
4. https://sm-nitk.vlabs.ac.in/exp/izod-impact-test/
5. https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/
6. https://sm-nitk.vlabs.ac.in/exp/tensile-test-mild-steel/
7. https://sm-nitk.vlabs.ac.in/exp/bending-test-mild-steel/
8. https://sm-nitk.vlabs.ac.in/exp/compression-test-mild-steel/
9. https://sm-nitk.vlabs.ac.in/exp/direct-shear-test-steel-rod/
10. https://sm-nitk.vlabs.ac.in/exp/torsion-test-mild-steel/

Course code	**LC-ME-226B**				
Category	Professional Core Courses				
Course title	**Fluid Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To gain knowledge of fluid flow principles and pipe flow behavior. ● To measure key flow parameters such as friction factor, Reynolds number, and viscosity. ● To know the causes and impact of energy losses in pipe systems. ● To provide hands-on experience to observe fluid flow phenomena through experiments.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Apply fluid flow measurement techniques to determine discharge coefficients and fluid properties.	L3: Apply
CO2	Calculate friction factor, Reynolds number, viscosity and flow losses in pipes.	L3: Apply
CO3	Analyze stability of floating bodies and fluid flow characteristics.	L4: Analyze
CO4	Evaluate the fundamental fluid properties and mechanics principles through experimentation.	L5: evaluate

List of Experiments

Sr. No.	Content	COs
1	To find out the coefficient of discharge of an orifice meter.	**CO1**
2	To find out the coefficient of discharge of venturi meter	**CO1**
3	To find out the coefficient of discharge of Notch (V and Rectangular types).	**CO1**
4	To find out the coefficient of discharge, contraction & velocity of an orifice.	**CO1**
5	To calculate the friction factor for the pipes.	**CO2**
6	To calculate the minor losses due to sudden enlargement, sudden contraction and bends.	**CO2**
7	To analyze the stability of a floating body by determining the metacentric height of a floating body.	**CO3**
8	To analyze the velocity and pressure variation with radius in a forced vertex flow.	**CO3**
9	To analyse the critical Reynolds number for a pipe flow.	**CO3**
10	To evaluate the viscosity of a fluid by Stokes' law apparatus.	**CO4**

11	To verify the Bernoulli's Theorem.	**CO4**
12	To verify the momentum equation.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web References:

1. https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/simulation.html
2. https://fm-nitk.vlabs.ac.in/exp/venturimeter/
3. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/simulation.html
4. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/about_setup.html
5. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/about_setup.html
6. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/metacenter/about_setup.html

Course code	**LC-ME-228B**				
Category	Professional Core Courses				
Course title	**Kinematics of Machines Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To provide knowledge of the basic elements and working principles of mechanical linkages and mechanisms. ● To introduce the motion characteristics of mechanisms used in machinery and equipment. ● To equip students with skills to analyse the performance of motion transmission systems such as cams, gears, and gear trains. ● To enable hands-on experience in evaluating the behaviour and efficiency of mechanical systems through laboratory experiments.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Understand various kinematic links, pairs, chains, and mechanisms, including their inversions.	L2: Understand
CO2	Apply graphical methods to draw displacement, velocity, and acceleration diagrams of mechanisms.	L3: Apply
CO3	Analyze the characteristics and profiles of cams, followers, and gears.	L4: Analyze
CO4	Evaluate the performance and efficiency of power transmission elements.	L5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To study various types of Kinematic links, pairs, chains and Mechanisms.	**CO1**
2	To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms.	**CO1**
3	To plot slider displacement, velocity and acceleration against crank rotation for single slider-crank mechanism.	**CO2**
4	To draw velocity diagram of four bar mechanism.	**CO2**
5	To draw velocity diagram of slider crank mechanism.	**CO2**
6	To draw acceleration diagram of four bar mechanism.	**CO2**
7	To categories various type of cam and follower arrangements.	**CO3**
8	To plot follower displacement vs cam rotation for various cam follower systems.	**CO3**
9	To classify various types of gears- spur, helical, worm, bevel gear etc.	**CO3**

10	To classify various types of gear trains - simple, compound, reverted & epicyclic.	**CO3**
11	To generate spur gear involute tooth profile using simulated gear shaping process.	**CO3**
12	To evaluate the MA, V.R. and efficiency of screw jack.	**CO4**
13	To evaluate the coefficient of friction between belt and pulley.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web References:

1. https://mm-nitk.vlabs.ac.in/exp/velocity-analysis-grashof/
2. https://mr-iitkgp.vlabs.ac.in/exp/cam-follower-mechanism/

Course code	**LC-ME-230B**				
Category	Professional Core Courses				
Course title	**3D Printing Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand the basics of FDM 3D printing and slicing ● software. ● To develop skills in STL file conversion and G-code generation. ● To design and fabricate 3D models using CAD and additive ● manufacturing techniques. ● To perform reverse engineering and print customized 3D objects ● using different materials.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the components, pre-processing and post procession of 3D printing.	L2: Understand
CO2	Explain slicing procedures, process parameters, and G-code generation for additive manufacturing.	L2: Understand
CO3	Use FDM-based 3D printing systems and prepare models for fabrication using appropriate printing materials and settings.	L3: Apply
CO4	Analyze the additive manufacturing materials and process parameters to achieve desired mechanical properties and performance of 3D-printed components.	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study the different components and configuration of an FDM 3D printer.	**CO1**
2	To study the various material options such as PLA, ABS, PETG, and others for 3D printing applications.	**CO1**
3	To study the Post Processing for 3D printing.	**CO1**
4	To study Slicing Software basics-I. Setting up the build temperature, nozzle temperature, speed, material, layer height	**CO2**
5	To study Slicing Software basics-II Setting up infill density, infill pattern, orientation of object, support material wall thickness, converting .stl file to .G-code file etc.	**CO2**
6	To convert a .stl file of a simple object into G code and print with FDM 3D Printer at 30% infill density.	**CO2**
7	To convert a .stl file of simple objects which require support material into G-code and print with FDM 3D Printer.	**CO2**
8	To make and print objects containing moving parts without assembly.	**CO3**
9	To make the Coupling in CAD software and print it using PLA material.	**CO3**

10	To make the key ring of your own name in CAD software and print it using PLA material.	**CO3**
11	To make a model of your own name and print it.	**CO3**
12	To Emboss / engrave your name on a 3D object and print it with ABS material.	**CO3**
13	Analyze the reverse engineering process by scanning a facial geometry using a 3D scanner, processing the scanned data, and resulting 3D-printed model.	**CO4**
14	To analyze the effect of various materials and printing parameters on the mechanical behavior of 3D-printed samples.	**CO4**
15	To analyze and optimize key printing parameters, including layer height, print speed, temperature, and infill patterns.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Web Reference:

1. https://3dp-dei.vlabs.ac.in/List%20of%20experiments.html
2. https://3dp-dei.vlabs.ac.in/?utm_source=chatgpt.com
3. https://www.nielit.gov.in/aurangabad/aurangabad/aurangabad/content/3d-printingadditive-manufacturing-lab?utm_source=chatgpt.com
4. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_me115
5. https://nptel.ac.in/courses/102106095

Course Code	**PEC-ME-212B**				
Category	Professional Elective Courses				
Course Title	**Industrial Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce to different recording charts and PPC. • To learn techniques for accurate sales forecasting and demand estimation. • To grasp inventory management principles for cost-effective control and stock optimization. • To know value analysis methods to enhance product and process value while reducing costs.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts and techniques related to industrial engineering.	L1: Remember
CO2	Explain the principles, procedures, techniques, and tools used to improve industrial systems.	L2: Understand
CO3	Apply standard methods, analytical and practical tools for managing industrial operations.	L3: Apply
CO4	Analyze industrial processes and organizational systems for performance improvement.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to work study; Method study; Basic procedure, Recording techniques (Charts and diagrams); Elemental breakdown; Micro-motion studies; Therbligs; SIMO- chart principles of motion- economy. Introduction; Objectives; techniques (time) information recording; methods of things, Time study allowances; work sampling technique, Performances rating and its determinant ion technique, Performance rating and its determination PMTS; M.T.M., Work factor.
Unit-II	Principle of organization; Importance and characteristics of organization; Organization theories; Classical Organization theory; Neo-Classical organization theory, modern organization theory; Types of organization. Military or line organization, Functional organization, line and staff organization, Committee objectives of PPC; Functions of PPC Preplanning and planning; Routing; Estimating; scheduling; master schedule; Daily schedule; Gantt chart; Dispatching.
Unit-III	Introduction, Objectives and importance of sales forecasting, Types of forecasting, Methods of sales forecasting, Collective opinion method, Delphi technique, economic indicator method; Regression analysis, introduction, Functions of inventory; Types of inventory; Control importance functions, Inventory costs, factors affecting inventory control, Various inventory controls models; A.B.C. analysis, lead-time calculations.

Unit-IV	Introduction, Objective; Concept and life cycle of a product and V.E.; Steps in V.E. Methodology and techniques, Fast diagram, Matrix method. Various concepts in industrial engineering. a) Wages and Incentives; Concept; Types, plans, Desirable characteristics. b) Supply Chain Management; Its Definition, Concept, Objectives, Applications, Benefits, some successful cases in Indian Industries. c) JIT; Its definition, concept, importance, misconception, relevance, Applications, Elements of JIT (brief description) d) Time Management; Introduction, steps of time man agreement, Ways for saving time KEY for time saving.

Suggested Readings:

1. Industrial Engineering and Organization Management-S.K. Sharma & Savita Sharma, KATSONs.
2. Industrial Engineering and Production Management by M. Mahajan, Dhanpat Rai & Co.
3. Production planning and control by S. Elion.
4. Industrial Engineering and management -I P Singh, Neelam Publications.

Web References:

1. https://youtu.be/BGxW2T8lhFU?feature=shared
2. https://youtu.be/iTBirKYQ6zw?feature=shared
3. https://youtu.be/xZs7WsNPJXY?feature=shared
4. https://youtu.be/6_3VHAAJddY?feature=shared
5. https://youtu.be/i7uPlBLBG4I?feature=shared
6. https://youtu.be/9tJv5COGkD0?feature=shared
7. https://youtu.be/PmR2SKeY9Ms?feature=shared
8. https://youtu.be/HkdoR-NNEoI?feature=shared

Course Code	**PEC-ME-214B**				
Category	Professional Elective Courses				
Course Title	**3D Printing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To aware the working principle and process parameters of additive manufacturing processes. • To learn applications of AM processes in various fields. • To know different post processing methods for AM. • To learn the basics of different tooling and its methods for AM				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamentals of additive manufacturing processes, materials, equipment, and applications.	L1: Remember
CO2	Explain STL conversion, additive manufacturing technologies, material characteristics, process parameters, and product quality requirements.	L2: Understand
CO3	Apply additive manufacturing principles for process, material, and post-processing selection in engineering applications.	L3: Apply
CO4	Analyze additive manufacturing systems, defects, troubleshooting methods, and application-specific requirements.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**3D Printing (Additive Manufacturing):** Introduction, Process, Classifications, Advantages, Additive v/s Conventional Manufacturing processes, Applications. **CAD for Additive Manufacturing:** CAD Data formats, Data translation, Data loss, STL format.
Unit-II	**Additive Manufacturing Techniques:** Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology, Process, Process parameter, Process Selection for various applications, Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools.
Unit-III	**Materials:** Polymers, Metals, Non-Metals, Ceramics Process, Process parameter, Process Selection for various applications, Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties, Support Materials. **Additive Manufacturing Equipment:** Process Equipment- Design and process parameters, Governing Bonding Mechanism, Common faults and troubleshooting, Process Design.
Unit-IV	**Post Processing:** Requirement and Techniques, Support Removal, Sanding, Acetone treatment, polishing. **Product Quality**: Inspection and testing, Defects and their causes.

Suggested Readings:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing- Lan Gibson, David W. Rosen and Brent Stucker, Springer, 2010.
2. Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing- Andreas Gebhardt, Hanser Publisher, 2011.
3. 3D Printing and Design- Khanna Editorial, Khanna Publishing House, Delhi.
4. 3D Printing and Rapid Prototyping- Principles and Applications- CK Chua, Kah Fai Leong, World Scientific, 2017.

Web References:

1. https://youtu.be/t7yv4gSnNkE?feature=shared
2. https://youtu.be/W2QpGdsTIJ8?feature=shared
3. https://youtu.be/Neb9IdIctmI?feature=shared
4. https://youtu.be/Aq6Ea8TBIbs?feature=shared
5. https://youtu.be/Ua7pEn7Rsws?feature=shared
6. https://youtu.be/jq9Lqil6bLw?feature=shared

Course Code	**PEC-ME-216B**				
Category	Professional Elective Courses				
Course Title	**CNC Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals and evolution of CNC technology. • To learn CNC machine structure, hardware components, and coordinate systems. • To learn manual and computer-aided part programming methods. • To enable students to gain programming skills and tooling knowledge.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the key concepts & components of CNC machines and part programming.	L1: Remember
CO2	Explain the working principles and structure of CNC systems and tooling.	L2: Understand
CO3	Apply CNC programming techniques to generate part programs for various machining operations.	L3: Apply
CO4	Analyze CNC machine operations & programs to improve machining efficiency and accuracy.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	Computer Numerical Control (CNC) Technology: Numerical Control (NC), Historical Development of CNC Machines, NC Coordinate Systems, NC Modes, Advantages and Limitations of CNC Machine Tools. CNC Hardware: Structure of CNC Machine tools, Drives used in CNC machines, Actuation Systems of CNC Machines Tools, Feedback Devices used in CNC Machine.
Unit-II	CNC Programming Fundamentals: Part Programming Steps, Axes Identification in CNC Turning and Machining Centres, Machine Zero and Home Position, ISO Standards for Coding. Manual Part Programming: Preparatory Functions, Miscellaneous Functions, Absolute and Incremental Programming, Tool Length Compensation.
Unit-III	Turning Centre Programming: Motion Commands, Tool Nose Radius Compensation, Cut Planning, Thread Cutting, Part Program Numerical. Machining Centre Programming: Canned Cycles, Cutter Radius Compensation, Part Program Numerical.
Unit-IV	Computer Aided Part Programming: APT Language, Geometry Statements, Motion Statements, Post Processor Statements, Auxiliary Statements, Part Program Numerical. CNC Tooling: Cutting Tool Material and Characteristics, Turning Tool Geometry, Tooling System for Turning, and Milling. Tool Presetting, Automatic Tool Changers, Work Holding.

Suggested Readings:

1. Computer Numerical Control: Operation and Programming by Jon Stennerson, Prentice Hall.
2. CNC Programming Principles & Applications by Mattson Mike, Cengage learning.
3. Machining and CNC Technology by Fitzpatrick, McGraw-Hill Higher Education.
4. Industrial Engineering and management by I P Singh, Neelam Publications.
5. CNC Tips and Techniques: A Reader for Programmers by Peter Smid, Industrial Press Inc.

Web References:

1. https://youtu.be/Gi42gKGiCl0?feature=shared
2. https://youtu.be/Mj6VbVL4tn0?feature=shared
3. https://youtu.be/PN_tGm5Gip4?feature=shared
4. https://youtu.be/_5r2XR1h1aQ?feature=shared

Course Code	**PEC-ME-218B**				
Category	Professional Elective Courses				
Course Title	**Composite Materials**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts of composite materials. • To learn the mechanical behaviour of composite materials. • To get an overview of the methods of manufacturing composite materials.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define the basic concepts and fundamental of composite materials.	L1: Remember
CO2	Describe the roles and characteristics of matrix and reinforcement materials in composite structures.	L2: Understand
CO3	Apply preparation and processing methods for different types of composite materials.	L3: Apply
CO4	Analyze the influence of composite composition & manufacturing techniques on material performance.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Content
Unit-I	**Introduction**: Definition - Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.
Unit-II	**Reinforcements**: Preparation-layup, curing, properties and applications of glass fibres, carbon fibres, Kevlar fibres and Boron fibres. Properties and applications of whiskers, particle reinforcements. Mechanical Behaviour of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.
Unit-III	**Manufacturing of Metal Matrix Composites:** Casting – Solid State diffusion technique, Cladding - Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration - Liquid phase sintering. Manufacturing of Carbon - Carbon composites: Knitting, Braiding, Weaving. Properties and applications.
Unit-IV	**Manufacturing of Polymer Matrix Composites**: Preparation of moulding compounds and prepregs - hand layup method – Autoclave method – Filament winding method- Compression moulding – Reaction injection moulding. Properties and applications.

Suggested Readings:

1. Hand Book of Composite Materials-George Lubin
2. Composite Materials– K.K. Chawla.
3. Composite Materials Science and Applications–Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tsai.

Web References:

1. https://youtu.be/0kB0G6WKhKE?feature=shared
2. https://www.youtube.com/watch?v=_JAGKikeCSY
3. https://youtu.be/649fIwvIvRc?feature=shared
4. https://www.youtube.com/watch?v=IZXHu5IQOrM
5. https://www.youtube.com/watch?v=dj8r0M5LsnQ
6. https://www.youtube.com/watch?v=aNie6dhPKZk
7. https://www.youtube.com/watch?v=bdC8yySkARs
8. https://www.youtube.com/watch?v=zC3M51uosDc
9. https://youtu.be/uO8EMAUh1po?feature=shared
10. https://www.youtube.com/watch?v=qos45EwMmd0
11. https://www.youtube.com/watch?v=T4C4m0Q8a6Q

Annexure AC/5.35

Annexure 4.5

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute
'A' GRADE ACCREDITED BY NAAC

Scheme of Studies and Examination

For

Minor Degree/Honours (Hons.)/Specialization

in

Robotics

Department of Mechanical Engineering

(Effective from the Academic Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

Minor Degree/Honours (Hons.)/Specialization
in
Robotics
Offered by Mechanical Engineering Department

Robotics is an interdisciplinary field that integrates engineering, science, and technology. It is a fascinating and rapidly growing area of study, as robots are being employed more and more in various sectors, including industry, research laboratories, and even households. The government is emphasizing and supporting the study and adoption of these emerging technologies. Institutions and Universities must incorporate them into education, training and research.

Keeping the above in view, the Department of Mechanical Engineering has started a Minor Degree/Honours (Hons.)/Specialization in **"Robotics"** with the aim of enhancing students' employability skills and imparting in-depth knowledge in emerging areas that are usually not covered in the undergraduate degree framework. These emerging areas will help students tap into the wide range of employment opportunities available in these domains.

This Minor Degree/Honours (Hons.)/Specialization will require earning 18-20 credits. It will be an addition to the regular undergraduate program, implying that passing or failing it will not affect the results of the regular undergraduate program being pursued by the student. Upon successful completion of the course, a Minor Degree/Honours (Hons.)/Specialization shall be awarded to the candidate. Students of Mechanical Engineering and other engineering programs shall be eligible for the Minor Degree/Honours (Hons.)/Specialization as outlined below:

Name of the Minor Degree/Honours (Hons.)/Specialization	**B. Tech Program whose students are eligible to opt for Minor Degree**	**B. Tech Program whose students are eligible to opt for Honours (Hons.)/Specialization**
Robotics	All B.Tech. Programmes except Mechanical Engineering, Electrical Engineering and Electronics & Communication Engineering	Mechanical Engineering, Electrical Engineering and Electronics & Communication Engineering.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

Minor Degree/Honours (Hons.)/Specialization in Robotics

(Effective from the Session: 2026-27)

Sr. No.	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	MMER-201B	Introduction to Robotics	3	0	0	3	3	30	45		75	3
2	IV	MMER-202B	Kinematics of Mechanisms and Machines	3	0	0	3	3	30	45		75	3
3	V	MMER-301B	Advanced Robotics	4	0	0	4	4	40	60		100	3
4	V	MLMER-303B	Robotics Lab	0	0	4	4	2	20		30	50	-
5	VI	MMER-302B	Microprocessors and Microcontrollers	4	0	0	4	4	40	60		100	3
6	VI	MLMER-304B	Microprocessors and Microcontrollers Lab	0	0	2	2	1	10		15	25	-
7	VII	MMER-401B	Modelling and Simulation of Dynamic Systems	3	0	0	3	3	30	45		75	3
Total Credits								**20**				**500**	

Note: To earn the required credits for the award of B. Tech Minor Degree/Honours (Hons.)/Specialization, students may choose either of the following:

(i) To enroll in courses offered through NPTEL/SWAYAM or other approved MOOCs platforms. The MOOCs courses shall be equivalent to the prescribed courses in the approved Scheme of Studies.
OR
Complete the prescribed courses in the same academic year as offered by the Department under the approved Scheme of Studies and Examinations.

(ii) The offering the courses in the specified semesters/years may be changed depending on the availability of equivalent courses on approved MOOCs platforms (SWAYAM/NPTEL, etc.), subject to the approval of the Department.

Course Code	**MMER-201B**				
Course Title	**Introduction to Robotics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce fundamental concepts and classifications of robotic systems. • To understand the construction and working of robotic end effectors and sensors. • To learn robot drives, actuators, and control strategies. • To familiarize students with robot programming techniques and emerging trends in robotics.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental concepts and terminology of robotics.	L1: Remember
CO2	Explain the working principles, parts, drives and control systems.	L2: Understand
CO3	Apply concepts and techniques to use suitable robotic systems.	L3: Apply
CO4	Analyze the robotic and automation system for specific applications.	L4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction to robotics:** Introduction, definition, need and scope of robotics; brief history and evolution of industrial robots; types of robots; laws of robotics; elements of robotic system i.e. robot anatomy and degrees of freedom (DOF); classification of robotic system on the based work volume, type of drive, and applications; performance parameters i.e. resolution, accuracy, repeatability, dexterity etc.; introduction to automation; industrial applications of robots.
Unit-II	**End Effectors:** Functions and types of end effectors; mechanical, pneumatic, hydraulic, magnetic and vacuum grippers; internal and external grippers; two fingered and three fingered grippers; remote center compliance (RCC) grippers; selection criteria and design considerations for grippers. **Sensors for robotics -** Need and role of sensors in robot operation; types and classification of sensors such as - position, proximity, force, tactile, vision sensors; characteristics and performance parameters of sensing devices; selection criteria for sensors; Introduction to machine vision systems.
Unit-III	**Robot Drives Systems:** Pneumatic drives, hydraulic drives, mechanical drives, electrical drives; D.C. servo motors, stepper motors and A.C. servo motors - salient features, applications and comparison; power transmission systems - gears, belts, lead screws, ball screws, and harmonic drives. **Control System**: Definition and classification; open and closed loop control systems with relative merits and demerits; introduction to linear and non-linear control systems in robotics.

Unit-IV	**Programming and Languages for Robotics:** Introduction to robot programming; basic motion commands and control structures; overview of common industrial robot programming languages. **Related Topics in Robotics**: Socio Economic aspect of robotization; economic considerations in robot selection and design; robot safety standards and industrial safety guidelines; introduction to artificial intelligence (AI) in robotics; applications of AI techniques in robotics; emerging trends in robotics - collaborative robots (COBOTS), Industry 4.0, IoT integration, autonomous systems.

Suggested Readings:

1. S. K. Saha, Introduction to Robotics, TATA McGraw Hills Education.
2. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House.
3. R. K. Mittal, I. J. Nagrath, Robotics and Control, TATA McGraw Hill Publishing Co Ltd, New Delhi.
4. A. B. Bhattacharya, Debasish Roy, Foundations of Robotics & Automation (Theory & Practice), Khanna Book Publishing.

Web References:

1. https://nptel.ac.in/courses/107106090
2. https://nptel.ac.in/courses/112104298
3. https://nptel.ac.in/courses/112105249
4. https://nptel.ac.in/courses/112105236
5. https://nptel.ac.in/courses/112107289
6. https://nptel.ac.in/courses/106102220

Course Code	**MMER-202B**				
Course Title	**Kinematics of Mechanisms and Machines**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce fundamental concepts and terminology of mechanisms and robotic systems. • To study kinematic structure and motion behavior of constrained mechanisms and robotic manipulators. • To learn Jacobian concepts and virtual work principles for motion and force analysis. • To analyze displacement, velocity, acceleration of constrained mechanisms and robotic manipulators.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental terminologies of mechanisms and robot kinematics.	L1: Remember
CO2	Explain the working principles and kinematic structure of mechanisms and robotic manipulators.	L2: Understand
CO3	Apply kinematic relations to calculate motion parameters of mechanisms and machines.	L3: Apply
CO4	Analyze displacement, velocity, acceleration, force transmission and Jacobian characteristics of mechanisms and robotic manipulators.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction to Mechanisms and Robotics**: Overview of mechanisms and robotics; terminology: link, joint, pair, chain, mechanism vs robot; kinematic diagrams; degree of freedom (DOF); DOF of planar and spatial kinematic chains; constrained mechanism and robotic mechanisms; failure of DOF calculation. **Mobility Analysis**: Grashof Criteria for simple planar mechanisms-4R chain, inversion and assembly modes; metamorphosis of 4R to 3R1P chain; Grashof Criteria for-3R1P, RRPP, RPRP chains; geometry concept; representation of vectors; vector projections.
Unit-II	**Displacement Analysis of Constrained mechanisms**: Four-bar (4R) chain; 3R1P chain Type-I and Type-II; application problems. **Displacement Analysis of Robot Manipulators:** Open chain planar manipulators 2 DOF (2R and RP) and 3-DOF (RPR); closed chain planar robots 2 DOF (2R, RPR) and 3 DOF (RPR).

Unit-III	**Geometric Velocity Analysis**: Motion of planar rigid body; instantaneous center of rotation; relative instantaneous center of rotation; Aronhold-Kennedy theorem and its application; geometric velocity analysis of 4R chain, 3R1P chain. **Analytical Velocity Analysis:** Analytical approach for 4R chain, 3R1P chain; velocity analysis of open chain planar robot manipulators (2R, RP); introduction to Jacobian matrix, velocity mapping and singularity concept in planar manipulators; velocity analysis of closed chain manipulators; path generation problems.
Unit-IV	**Acceleration Analysis:** Relative and absolute acceleration; Input-output acceleration relations; analytical acceleration analysis of 4R, 3R1P mechanisms, acceleration analysis of open chain planar robots (2R). **Force Analysis:** Concept of force and torque transmission; static force analysis of planar mechanisms; principle of virtual work; force analysis of constrained mechanisms (4R, 3R1P chain) and open chain planar robots (2R).

Suggested Readings:

1. S. S. Rattan “Theory of Machines” Tata McGraw-Hill Education Pvt. Ltd., New Delhi.
2. Saeed B. Niku, "Introduction to Robotics: Analysis, Systems, Applications", Pearson Education India.
3. John J. Craig, “Introduction to Robotics: Mechanics and Control” Pearson Education India.
4. Mikell P. Groover, " Industrial Robotics", Tata McGraw-Hill Education India.

Web References:

1. https://nptel.ac.in/courses/112105236
2. https://nptel.ac.in/courses/112105268

Course Code	**MMER-301B**				
Course Title	**Advanced Robotics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • To make mathematical and kinematic models of robotic manipulators. • To formulate velocity, static, and dynamic behavior of robotic systems. • To formulate trajectory planning and feedback control strategies for manipulators. • To introduce principles of robotic grasping and legged locomotion.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental concepts and terminologies of robotics.	L1: Remember
CO2	Explain mathematical models, kinematic and dynamic relationships, control strategies, and manipulation principles in robotic systems.	L2: Understand
CO3	Use mathematics, mechanics, control, and manipulation principles to solve robotic problems.	L3: Apply
CO4	Analyze the robotic mechanics, modelling and control techniques for robot systems.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Mathematical Preliminaries of Robotics**: Overview of robotic system; coordinate frames; 2D & 3D Transformations - translation, rotation, reflection, scaling, shearing; compound transformations; inverse transformations; homogeneous coordinates; homogeneous transformations matrices. **Robot Kinematics**: Denavit-Hartenberg Approach; Standard DH convention; D-H parameters; deriving transformation matrices; forward kinematics; inverse kinematics - geometric and analytical approach.
Unit-II	**Velocities Analysis & Jacobians**: Linear and angular velocity; joint velocity relationships; time differentiation of transformation matrices; basic Jacobian; Jacobian matrix derivation; kinematic singularity & redundancy; force balance equation; velocity - force Duality; virtual work; force ellipsoid. **Robot Dynamics:** Introduction to robot dynamics; rigid body acceleration; Newton-Euler's formulation; Lagrangian formulation, derivation of manipulator dynamic equations; mass matrix; Coriolis and centrifugal terms; nonlinear robot dynamics; actuator modeling.
Unit-III	**Trajectory Planning and Control**: Joint space trajectory planning; Cartesian space trajectory planning; polynomial trajectory planning; open-loop and closed-loop control; Proportional (P), Proportional-Derivative (PD), Proportional-Integral-Derivative (PID) control of manipulator.

	Sensors and Robotic Perception: Types of Sensors - position sensors, velocity sensors, force/torque sensors, vision sensors, tactile sensors; sensor integration - feedback mechanisms, state estimation, error correction; actuation Systems - electric, hydraulic, and pneumatic actuators, actuator selection criteria.
Unit-IV	**Robotic Grasping and Manipulation:** Fundamentals of grasping; types of robotic grippers; grasp analysis - form closure, force closure, grasp matrix; stability analysis; kinematics of multi-finger systems; force distribution and dexterous manipulation. **Legged Robotics and Locomotion:** Fundamentals of locomotion - active vs passive walking; static vs dynamic walking, zero moment Point (ZMP) – Definition and mathematical formulation, Balance control- modeling of biped systems; gait generation; walking cycle phases; Design & Optimization of Legged Robots

Suggested Readings:

1. R. K. Mittal, I. J. Nagrath, Robotics and Control, Tata McGraw Hill.
2. M. Spong, S. Hutchinson, M. Vidyasagar, Robot Modeling and Control, Wiley & Sons.
3. John J. Craig, Introduction to Robotics: Mechanics and Control, 3rd Edition, Pearson Education.

Web References:

1. https://nptel.ac.in/courses/112104316

Course Code	**MMER-302B**				
Course Title	**Microprocessors and Microcontrollers**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts of microprocessors and microcontrollers, focusing on the architecture, functional blocks, and signal descriptions of 8086 and 8051. • To provide knowledge of instruction sets, addressing modes, assembler directives, and assembly language programming. • To learn interfacing techniques of microprocessors and microcontrollers with memory, peripheral ICs, and devices such as ADC/DAC, keyboard, LCD, and LEDs. • To explore microcontroller programming, embedded applications, and recent advancements in processor technologies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the architecture, functional blocks, registers, and signals of 8086 microprocessor and 8051 microcontrollers.	L1: Remember
CO2	Explain the instruction sets, addressing modes, assembler directives, and programming concepts of 8086 and 8051.	L2: Understand
CO3	Apply assembly language programming and interfacing techniques to design circuits with memory, peripheral ICs and devices such as ADC/DAC, keyboard, LCD, and LEDs.	L3: Apply
CO4	Analyze microcontroller-based embedded applications by integrating programming, interfacing, and system design concepts for real-world problem solving.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Fundamentals & 8085 Overview:** Evolution of microprocessors,8085 microprocessors, instruction set, Architecture, Basic Computer Organization Concepts **8086 Microprocessor:** Functional Diagram, Register Organization, Memory Segmentation, Signal Descriptions-Common Function Signals, Minimum and Maximum Mode Signals, Timing Diagrams, Interrupts of 8086.
Unit-II	**Assembly Language Programming of 8086:** Instruction set and addressing modes, Assembler directives, Assembly programming logical, branch, and call instructions, evaluating arithmetic expressions, string manipulations.

Unit-III	**Memory & Peripheral Interfacing:** Interfacing with RAMs and ROMs, Peripheral ICs: 8255(programmable peripheral interface), 8259 (programmable interrupt controller), 8254 (programmable timer), LEDs, LCDs, Sensor/Transducer & Actuator Interfacing **Advanced Interfacing & System Concepts:** ADCs and DACs interfacing. Bus structure and timing, Interrupt handling and DMA concepts. Standard Interfaces (RS-232, USB).
Unit-IV	**8051 Architecture & Core Features:** Overview of 8051 microcontrollers, architecture, memory organization, Inbuilt modules: timers, serial communication, port operation, special function registers, timing and control, interrupts. **Programming, Interfacing & ARM:** Instruction set and programming: operand types, addressing modes, data transfer, arithmetic, logic, and control transfer instructions,8051 interfacing: memory and I/O interfacing - Introduction to ARM Cortex-M series. Application Examples of Microprocessors/Microcontrollers

Suggested Readings:

1. Douglas V. Hall, Microprocessors and Interfacing Programming and Hardware, Gregg Division, McGraw-Hill 2nd Edition.
2. Kenneth J. Ayala, The 8051 Microcontroller, Cengage Learning, Thomson Delmar 3rd Edition
3. A Nagoor Kani, Microprocessors and Microcontrollers, CBS Publishers.
4. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085, Penram International Publishing/ Prentice Hall 6th Edition.
5. Eldhose P. Sim, A Comprehensive Guide for Microprocessor and Microcontroller, Notion Press 1st Edition.
6. Santanu Chattopadhyay, Microprocessors & Microcontrollers, McGraw Hill 1st Edition.

Web Reference:

1. https://nptel.ac.in/courses/108105102

Course Code	**MMER-401B**				
Course Title	**Modelling and Simulation of Dynamic Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VII**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamental principles of modelling and simulation of dynamic systems. • To build mathematical model for representing dynamic systems. • To equip students to simulate and optimize dynamic systems. • To interpret system responses for performance predication.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total Marks	75				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental principles of modelling and simulation of dynamic systems.	L1: Remember
CO2	Explain the dynamic systems interactions using appropriate modeling approaches.	L2: Understand
CO3	Apply modelling and simulation techniques to and optimize dynamic systems.	L3: Apply
CO4	Analyze the system responses to predict performance and dynamic characteristics.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Modelling and Simulation**: Introduction to modelling and simulation; types and classification of models; mathematical modelling of dynamic systems, introduction to simulation techniques: MATLAB as a Simulation tool. **Bond Graphs Modelling**: Elements of bond graph; causality assignment, generation of system equations, procedure for constructing bond graph models.
Unit-II	**Basic System Models**: Mathematical modelling of mechanical systems, electrical systems, hydraulic systems, pneumatic systems, thermal systems. **Combined Systems**: Linearity and non-linearity in systems, modelling of combined rotary and translatory systems, electro-mechanical systems, hydro-mechanical systems and basic modelling of robotic systems.
Unit-III	**Dynamic Response and Transfer Function:** Dynamic response of the first order system, second order system; performance measure of second order system; transfer function representation of dynamic systems. **System Representation Techniques**: Block diagram algebra; signal flow graphs; state space formulation; frequency response analysis; bode plot and interpretation.
Unit-IV	**Simulation Applications**: Simulation using SIMULINK, simulation of simple and compound pendulum, simulation of planar mechanism, model validation and verification techniques. **Parameter Estimation and Optimization:** Parameter estimation methods; system identifications techniques; introduction to optimization; optimization of engineering systems using modelling and simulation tools.

Suggested Readings:

1. Dean C. Karnopp, Donald L. Margolis, Ronald C. Rosenberg, “System Dynamics: Modelling, Simulation, and Control of Mechatronic Systems” Wiley India Pvt. Ltd.
2. Katsuhiko Ogata, "System Dynamics: Modelling and Simulation of Mechatronic Systems", Pearson Education India.
3. Robert L. Woods, Kent L. Lawrence, “Modeling and Simulation of Dynamic Systems”, PHI Learning Pvt. Ltd., New Delhi.
4. Averill M. Law, W. David Kelton, "Simulation Modeling and Analysis", Tata McGraw-Hill Education India.
5. Wolfgang Borutzky, “Bond Graph Modelling of Engineering Systems” Springer India.
6. S. N. Shivanandam, S. P. Shivanandam, “Introduction to MATLAB & SIMULINK for Engineers” Wiley India

Web Reference:

1. https://nptel.ac.in/courses/112107214

Course code	**MLMER-303B**				
Course title	**Robotics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	0	0	4	**2**	
Course Objectives	The objectives of this course are • To study robot configurations, applications, and laboratory safety rules. • To teach a robotic arm points using a teach pendant. • To explore complex trajectories using a robotic arm. • To familiarise with various operations using a robotic arm.				
Assessment	20 Marks				
End Semester Practical Examination	30 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Describe the basic facts, concepts, and safety rules.	L2: Understand
CO2	Explain the basic operational procedure of robotic arm.	L2: Understand
CO3	Apply the procedure to demonstrate the various types of robot operations.	L3: Apply
CO4	Analyze engineering requirements and select a suitable end effector for a given robotic application	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study different robotic configurations and their applications.	**CO1**
2	To study various safety rules and precautions followed in robotics lab.	**CO1**
3	To study and perform the homing operation of a robotic arm.	**CO2**
4	To teach robotic arm a point in space by using teach pendant.	**CO2**
5	To draw a triangle in particular frame by using robotic arm.	**CO3**
6	To draw a circle in particular frame by using robotic arm.	**CO3**
7	To make a complicated shape involving arcs and circle by using teach pendent.	**CO3**
8	To select suitable operating parameters and perform pick-and-place operation using a vacuum gripper using a robotic arm.	**CO4**
9	To select appropriate operating parameters and perform material sensing operation by using robotic arm.	**CO4**
10	To select suitable operating parameters and perform two finger pick-and-place operation using a robotic arm.	**CO4**
11	To select appropriate operating parameters and perform magnetic pick and place operation by using robotic arm.	**CO4**

12	To select appropriate operating parameters and perform color sensing operation by using robotic arm.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Course code	**MLMER-304B**				
Course title	**Microprocessors and Microcontrollers Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • Understand architecture and working of Microprocessor and Microcontroller. • Learn assembly programming for arithmetic and data operations. • Provide hands-on experience in interfacing various peripherals with processor-based systems.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the architecture and functioning of microprocessors and microcontroller used in robotics applications.	L2: Understand
CO2	Implement programs for arithmetic, data processing, and mathematical computations.	L3: Apply
CO3	Apply interfacing techniques to connect peripherals with computing devices for practical applications.	L3: Apply
CO4	Analyze embedded control algorithms for hardware interfacing and timing operations in robotics systems.	L4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study the architecture, pin configuration, and functional blocks of the 8085-microprocessor using an 8085-trainer kit.	**CO1**
2	Write and execute 8085 assembly language programs to perform arithmetic operations such as addition, subtraction, multiplication, and division	**CO2**
3	To study and analyze the architecture, pin configuration, and functional blocks of the 8086-microprocessor using the trainer kit.	**CO1**
4	To write and execute an 8086-assembly language program to add the contents of two memory locations and store the result in a third memory location.	**CO2**
5	To write and execute an 8086-assembly language program to perform addition and subtraction of 16-bit numbers using the 8086-instruction set.	**CO2**
6	To write and execute an 8086-assembly language program to perform multiplication and division of 16-bit numbers using the 8086-instruction set.	**CO2**
7	Write an assembly language program to calculate the factorial of a given number using the 8086-instruction set.	**CO2**
8	Write an 8086-assembly language program to find the average of two given numbers using the 8086-instruction set.	**CO2**
9	To write and execute an 8086-assembly language program to interface a stepper motor using 8255 PPI and control its rotation.	**CO3**

10	To study the architecture and pin configuration of the 8051 microcontroller and understand the functions of its ports, control signals, and special purpose pins.	**CO1**
11	To write and execute a program to generate a square wave using the 8051 microcontrollers.	**CO4**
12	To write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Course Code	**OEC-04A**				
Category	Open elective Courses				
Course Title	**Project Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To understand the fundamentals and life cycle of project management. • To study project selection and feasibility analysis methods. • To apply project planning, scheduling, and resource management techniques. • To understand project monitoring, control, and completion processes.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts, terminology, and phases of project management.	L1: Remember
CO2	Explain the project planning, scheduling, and resource allocation, implementation, and control techniques.	L2: Understand
CO3	Apply project management tools and techniques for project planning, scheduling, monitoring and execution.	L3: Apply
CO4	Analyze project performance, resource utilization, and project evaluation methods for effective project management.	L 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Project Management:** Meaning and scope, Need of project management, Life cycle of a project - conception and selection, planning and scheduling, implementation and control, evaluation and termination.
Unit-II	**Project Analysis and Selection:** Identification of investment opportunities, project initiation, Market and Demand Analysis, Technical Analysis, Economic and Financial Analysis, Social Cost and Benefit Analysis, Formulation of Detailed project report.
Unit-III	**Project Planning & Scheduling:** Planning Resources, Planning of Physical Resources, Planning of Human Resources, Planning Financial Resources, Project organizing, Planning Time Scales-Network/PERT Analysis.
Unit-IV	**Implementation and Control:** Project Management Information System, Monitoring and Reporting Physical resources, human resources, and financial resources-cost control. **Project Completion and Evaluation:** Integrated Project Management Control System, managing Transition for project to operation, project completion and evaluation, project review, project termination.

Suggested Readings:

1. Project Planning, Scheduling and Control- James P Lewis, Tata McGraw-Hill Publishing Co Ltd.
2. Project Management- A Socio-Technical Approach- Erik W. Larson, Clifford F. Gra, Tata McGraw-Hill
3. Project Management- A Managerial Approach- Jack R Meredith, Samuel J. Mantel, Wiley India Private Limited
4. Project Management Body of Knowledge (PMBOK), Project.
5. Handbook for project-oriented organization, Rath S. Hoogland, R. and Turner, J.R.
6. Project Management for Engineering, Business and Technology- John M Nicholas
7. Project Management handbook, Cleland, D.I. and W.R. King, USA.

Web Reference:

1. https://nptel.ac.in/courses/110107430
2. http://www.digimat.in/nptel/courses/video/110104073/L02.html
3. http://www.digimat.in/nptel/courses/video/110107081/L01.html

Course Code	**OEC-09A**				
Category	Open Elective Courses				
Course Title	**Fundamentals of Additive Manufacturing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To aware the working principle and process parameters of additive manufacturing processes. • To learn applications of AM processes in various fields. • To know different post processing methods for AM. • To learn the basics of different tooling and its methods for AM.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic concepts, classifications, and applications of additive manufacturing technologies.	L1: Remember
CO2	Explain the processes, materials, and software used in additive manufacturing and reverse engineering.	L2: Understand
CO3	Apply additive manufacturing principles to model development, data processing, and part fabrication.	L3: Apply
CO4	Analyse additive manufacturing processes and post-processing methods for suitability and efficiency in various applications.	L4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**3D Printing (Additive Manufacturing):** Introduction, Process, Classifications, Advantages, Additive v/s Conventional Manufacturing processes, Applications. **CAD for Additive Manufacturing:** CAD Data formats, Data translation, Data loss, STL format.
Unit-II	**Additive Manufacturing Techniques:** Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology, Process, Process parameter, Process Selection for various applications, Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defense, Automotive, Construction, Food Processing, Machine Tools.
Unit-III	**Materials:** Polymers, Metals, Non-Metals, Ceramics Process, Process parameter, Process Selection for various applications, Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties, Support Materials. **Additive Manufacturing Equipment:** Process Equipment- Design and process parameters, Governing Bonding Mechanism, Common faults and troubleshooting, Process Design.
Unit-IV	**Post Processing:** Requirement and Techniques, Support Removal, Sanding, Acetone treatment, polishing. **Product Quality**: Inspection and testing, Defects and their causes.

Suggested Readings:

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, 2nd Edition, Springer, 2015
2. Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003
3. 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping, Chee Kai Chua, Kah Fai Leong, World Scientific Publishers, 2014
4. Additive Manufacturing Technologies, Ian Gibson, David W. Rosen, Brent Stucker, Springer,2009

Web Reference:

1. https://nptel.ac.in/courses/112103306
2. https://nptel.ac.in/courses/112101623
3. https://nptel.ac.in/courses/113108632

Annexure AC/5.37

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS
GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

An Autonomous Institute | NAAC 'A' Grade Institute | Affiliated to MDU, Rohtak

Minutes of 4thMeeting of Board of Studies of Computer Science and Applications Department held on 30.05.2026

The 4th meeting of Board of Studies of Department of Computer Science and Applications was held on 30.05.2026 at 11:30 A.M in the Conference Hall of the Institute.

The following members were present for the BOS meeting:

S. No	Name of the Member	Designation/Affiliation	Category
1	Prof. (Dr.) Anil Kumar	Department of Computer Science and Applications	Chairperson, Chairperson of Board of Study
2	Prof. Rahul Rishi (Deptt. of CSE, UIET, MDU, Rohtak)	Professor, UIET, Rohtak	University Nominee
3	Prof. Shailender Verma (Deptt of CSE, DTU, Delhi)	Professor, DTU, Delhi	Subject Expert, Outside the Parent University
4	Dr. Virendra P. Vishwakarma	Professor, USICT, Guru Gobind Singh Indraprastha University,New Delhi	Subject Expert, Outside the Parent University
4	Mr. Jitender Singh	Member	Internal Member
5	Dr. Praveen Kumari	Member	Internal Member
6	Mrs. Minu Rani	Member	Internal Member
7	Dr. Kavita	Member	Internal Member
8	Ms. Pooja	Member	Internal Member
9	Ms. Rani	Member	Internal Member
10	Ms.Annu	Member	Internal Member
11	Ms. Chandani Sahu	Member	Internal Member
12	Mr. Deepak	Member	Internal Member
13	Ms.Yogindra	Member	Internal Member
14	Ms. Jyoti Pandey	Member	Internal Member
15	Ms. Swati Saraf	Member	Internal Member
16	Ms. Sweta	Member	Internal Member
17	Ms. Renu	Member	Internal Member
18	Ms. Ankita	Member	Internal Member
19	Ms. Komal Rawat	Member	Internal Member
20	Mr. Deepak	Member	Internal Member
21	Ms. Divya	Member	Internal Member
22	Ms. Neelam	Member	Internal Member
23	Mr. Sachin Kumar	Member	Internal Member

24	Ms. Nitika	Member	Internal Member
25	Mr. Yumesh	Member	Internal Member
26	Ms. Seema Rani	Member	Internal Member
27	Ms. Inderjeet Kaur	Member	Internal Member
28	Ms. Annu Rani	Member	Internal Member
29	Ms. Nisha	Member	Internal Member
30	Ms. Preeti Rani	Member	Internal Member
31	Dr. Vivek Kumar	Registrar & COE, GITAM Kablana	Special Invitee
32	Dr. Nitin Kumar	HOD, CSE, GITAM Kablana	Special Invitee

At the outset the Chairperson welcomed all the members present in the meeting. The agenda items, as circulated prior to the meeting, were taken up for discussion.

Agenda wise Discussion and Resolutions

Item 4.1

Confirmation of the Minutes of 3rdMeeting of the Board of Studies of Computer Science and Applications held on 22.12.2025.

To confirm the minutes of 3rd meeting of the Board of Studies of Computer Science and Applications held on 22.12.2025**(Annexure 4.1 Pages 1-4 already circulated).**

RESOLVED THAT THE MINUTES OF 3RD MEETING OF THE BOARD OF STUDIES OF COMPUTER SCIENCE AND APPLICATIONS HELD ON 22.12.2025(ANNEXURE 4.1 PAGES 1-4 ALREADY CIRCULATED) BE CONFIRMED.

Item 4.2

Follow up Action Report on the decisions taken in the 3rdmeeting of Board of Studies of Computer Science and Applications held on 22.12.2025.

To note the follow-up action report on the decisions taken in the 3rd meeting of Board of Studies of Computer Science and Applications held on 22.12.2025 **(Annexure 4.2 Page 5 already circulated).**

RESOLVED THAT THE FOLLOW-UP ACTION REPORT ON THE DECISIONS TAKEN IN THE 3RD MEETING OF THE BOARD OF STUDIES OF COMPUTER SCIENCE AND APPLICATIONS HELD ON 22.12.2025(ANNEXURE 4.2 PAGE 5 ALREADY CIRCULATED) BE NOTED.

Item 4.3

Revisions in MCA Software Laboratories (Software Lab–1 to Software Lab–8 and Bridge Course Lab), Dissertation-I Evaluation Criteria, Dissertation-II Evaluation Criteria, and PT Evaluation Criteria w.e.f. 2026-27

The syllabi of following lab courses are revised

S. N	Category	Course Code	Course Title	Semester
1	Experiential Learning	EL-MCA-101A	**Software Lab-1**	1st
2	Experiential Learning	EL-MCA-117A	**Software Lab-2**	1st
3	Bridge Course- LAB	BC-MCA-125A	**Software Lab-Bridge Course**	**Bridge Course**
4	Experiential Learning	EL-MCA-108A	**Software Lab-3**	2nd
5	Experiential Learning	EL-MCA-110A	**Software Lab-4**	2nd
6	Experiential Learning	EL-MCA-207A	**Software Lab-5**	3rd
7	Experiential Learning	EL-MCA-209A	**Software Lab-6**	3rd
8	Experiential Learning	EL-MCA-208A	**Software Lab-7**	4th
9	Experiential Learning	EL-MCA-210A	**Software Lab-8**	4th

The revised syllabiMCA Software Laboratories (Software Lab–1 to Software Lab–8 and Bridge Course Lab) *w.e.f 2026-2027* as attached **(Annexure 4.3 Pages 6-41)**. The MCA Software Laboratories (Software Lab–1 to Software Lab–8 and Bridge Course Lab), Dissertation-I and Dissertation-II evaluation criteria, and PT evaluation have been revised to align the curriculum and assessment process with current academic and industry requirements. The revisions aim to improve the practical learning experience, ensure consistency and transparency in evaluation, strengthen project-based learning and research outcomes, and better assess students' technical knowledge, problem-solving abilities, and professional competencies.

The Board of Studies of Computer Science and Applications may consider and approved the revised syllabi of the above mention Software Laboratories.

RESOLVED THAT THE BOARD OF STUDIES OF COMPUTER SCIENCE AND APPLICATIONS CONSIDERED AND APPROVED THE REVISED SYLLABI OF THE ABOVE-MENTIONED SOFTWARE LABORATORIES.
FURTHER RESOLVED THAT THE APPROVED SYLLABI BE RECOMMENDED TO THE ACADEMIC COUNCIL FOR ITS APPROVAL.

Item 4.4

Scheme of Examinations and Syllabi of BCA 3rdYear (A- Scheme) *w.e.f* 2026-27.

The proposed Scheme of Examinations and Syllabi for 3rd year of BCA (A-Scheme) *w.e.f.* 2026-27 is attached as **(Annexure 4.4 Pages 42-99).** The BOS may consider and approve the Scheme of Examinations and Syllabi (A-Scheme) of BCA 3rd year.

RESOLVED THAT THE BOARD OF STUDIES OF COMPUTER SCIENCE AND APPLICATIONS CONSIDERED AND APPROVED THE SCHEME OF EXAMINATIONS AND SYLLABI OF BCA 3RD YEAR (A-SCHEME) (ANNEXURE 4.4 PAGES 42-99) BE APPROVED AND FURTHER RESOLVED THAT THE SCHEME OF EXAMINATIONS AND SYLLABI OF 3RD YEAR (A-SCHEME) AS MENTION ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.5

Revised (Credit Structure, Scheme of Examinations and Syllabi of BCA-1st year B-Scheme NEP 2020)*w.e.f*2026-27.

The Board of Studies of Computer Science and Applications approved the Scheme of Examination and Syllabi (B-Scheme) of BCA 2nd semester in its meeting held on 22.12.2025. As per the recommendations of the Board of Studies, the Scheme of Examination and Syllabi is revised for BCA 1st year *w.e.f* 2026-27**(Annexure 4.5 Pages 100-164).**The Board of Studies of Computer Science and Applications may consider and approve the Scheme of Examinations and Syllabi of BCA1st year(Revised B-Scheme). The revised Scheme will be applicable to students admitted from the academic session 2026–2027 onwards. However, for re-appear students admitted during the academic session 2025–2026 (if any), the previous B-Scheme will be applicable.

RESOLVED THAT THE BOARD OF STUDIES OF COMPUTER SCIENCE AND APPLICATIONS CONSIDERED AND APPROVED THE SCHEME OF EXAMINATIONS AND SYLLABI OF BCA 1ST YEAR (REVISED B-SCHEME) (ANNEXURE 4.5 PAGES 100-164) . FURTHER RESOLVED THAT THE REVISED SCHEME OF EXAMINATION AND SYLLABI AS MENTION ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.6

Scheme of Examinations and the Syllabi of BCA 2nd Year (B Scheme)*w.e.f* 2026-27.

The Scheme of Examinations and Syllabi for BCA 2nd year *w.e.f* 2026-2027 attached as **(Annexure 4.6 Pages 165-232).**The BOS may consider and approve the Scheme of Examinations and Syllabi (B-Scheme) for BCA2ndyear*w.e.f* 2026-2027.

RESOLVED THAT THE SCHEME OF EXAMINATIONS AND SYLLABI OF BCA2nd YEAR (B-SCHEME) *W.E.F*2026-27 (ANNEXURE 4.6 PAGES 165-232) BE APPROVED AND FURTHER RESOLVED THAT THE SCHEME OF EXAMINATIONS AND SYLLABI OF BCA2nd YEAR(B-SCHEME) AS MENTION ABOVE IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item 4.7

Panel of Examiners for Theory and Practical Examinations of BCA and MCA Programs for Academic Session 2026-27.

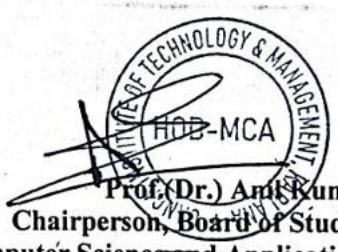
The Board of Studies of Computer Science and Applications in its meeting held on 22.12.2025 vide its Resolution No. 3.5, has approved the Panel of Examiners. The BOS may now review the existing panel **(Annexure 4.7 Pages 233-236).** To ensure the inclusion of additional eligible and qualified examiners if required, to further strengthen the evolution process for the upcoming academic year.

RESOLVED THAT THE BOARD OF STUDY REVIEWED AND APPROVED THE PANEL OF EXAMINERS FOR THEORY AND PRACTICAL EXAMINATIONS FOR THE ACADEMIC SESSION 2026-27. FURTHER RESOLVED THAT THE APPROVED PANEL BE FORWARDED TO THE CONTROLLER OF EXAMINATIONS FOR FURTHER NECESSARY ACTION.

Item 4.8

Any Other Item with the Permission of the Chair.

There being no other item for discussion, the meeting concluded with a vote of thanks to the chair.



Prof. (Dr.) Anil Kumar
Chairperson, Board of Studies
Department of Computer Science and Applications
Ganga Institute of Technology and Management, Jhajjar

Annexure AC/5.38

~~Annexure 4.3~~

Revised MCA Software Laboratories (Software Lab–1 to Software Lab–8 and Bridge Course Lab), Evaluation Criteria of Dissertation-I, Dissertation-II and PT Evaluation.

Course Code	**EL-MCA-101A**				
Category	Experiential Learning				
Course Title	**Software Lab-1**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to ● Apply Java syntax, data structures, control flow, and OOP principles (classes, objects, inheritance, and polymorphism). ● Design and implement Java apps using OOP features, exception handling, and multithreading for efficient software. ● Design user-friendly GUIs using AWT components (buttons, labels, text fields) for smooth user interactions. ● Manage errors with exception propagation, exception objects, and effective exception handling strategies.				
Internal Assessment	50Marks				
External Practical	50 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Implement object-oriented concepts such as inheritance, abstraction, interfaces, event handling, and graphics algorithms in Java and C/C++.	Level 3: Apply
CO2	Analyze and debug Java programs, algorithms for geometric transformations, and multi-threading applications for optimization and error resolution.	Level 4: Analyze
CO3	Evaluate the efficiency and functionality of matrix multiplication, event handling techniques, graphical algorithms, and multi-threading in Java and C/C++.	Level 5: Evaluate
CO4	Design and develop Java applications and C/C++ programs for graphical transformations, event-driven programming, and multi-threading with real-time functionality.	Level 6: Create

List of Experiments:

Sr. No.	**Contents**
1	Write a Java program that converts temperatures between Celsius and Fahrenheit based on user input using methods for conversion and input validation.
2	Implement a Java program to perform matrix addition, multiplication operations using arrays and methods.

3	Write Java program to find the largest and smallest elements in an array.
4	Write a program to implement method overloading.
5	Develop a Java program to implement inheritance by creating a base class Animal and derived classes like Dog and Cat
6	Write a Java program to demonstrate method overriding by implementing a base class Shape, and derived classes Circle and Rectangle.
7	Write a program to handle exceptions using try-catch, multiple catch clauses, and finally block.
8	Write a program to create and run multiple threads.
9	Write a program to demonstrate the different methods involved in the thread life cycle.
10	Write a program to perform read and write operations on files using File Input Stream and File OutputStream.
11	Create a GUI application with AWT components and handle events using delegation event model.
12	Demonstrate the use of different layout managers and create menus in a GUI application
13	Create a GUI application with Java Swings
14	Write a program to connect to a database and perform basic CRUD operations using JDBC.

Suggested Readings:

- The Complete Reference JAVA, TMH Publication, 1972.
- JAVA 2 UNLEASHED, Tech Media Publications, 2002.
- Patrick Naughton, Herbert, Schild, *The Complete reference Java 2*, Tata Mc-Graw Hill.
- 2. E. Balaguruswamy*Programming with JAVA- A Primer*, Tata Mc-Graw Hill publication

Reference Books:

1. Maydene Fisher, Jon Ellis, Jonathan Bruce, *JDBC API Tutorial and Reference*, Addison Wesley.
2. Giulio Zambon, *Beginning JSP, JSF and Tomcat*, APress

Useful Video Links:

Experiment No.	Experiment Name	Links
1	Introduction of java and types	https://archive.nptel.ac.in/courses/106/105/106105191/
2	Arrays and Strings types in java	https://www.youtube.com/watch?v=VksxhzfD8kQ
3	Packages in java	https://www.youtube.com/watch?v=TwU3cv1FFis
4	Interface Fundamentals in java	https://www.youtube.com/watch?v=nFH-Hm8iTR0

Course Code	**EL-MCA-117A**				
Category	Experiential Learning				
Course Title	**Software Lab-2**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • Understand and Apply Core Concepts of Algorithm Analysis. • Design and Implement Tree Data Structures and Traversal Algorithms. • Implement Graph Algorithms for Problem Solving. • Solve Optimization Problems Using Dynamic Programming and Backtracking. • Implement Advanced String-Matching Algorithms for Text Searching.				
Internal Assessment	50 Marks				
External Practical	50 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Apply sorting algorithms, tree traversals, graph search techniques, and string matching algorithms to solve computational problems in programming.	Level 3: Apply
CO2	Analyze the time and space complexities of sorting algorithms, tree operations, and optimization problems, evaluating their efficiency.	Level 4: Analyze
CO3	Critically assess the performance and correctness of algorithms such as KMP, Prim's, Kruskal's, and dynamic programming solutions for optimization problems.	Level 5: Evaluate
CO4	Design and develop efficient solutions for graph and tree-based problems, including tree balancing, minimum spanning tree, and optimization problems.	Level 6: Create

List of Experiments

Sr. No.	**Contents**
1	Write a program that uses functions to perform the following operations on an array i) Creation ii) Insertion iii) Deletion iv) Traversal.
2	Write a program that uses functions to perform the following operations on strings i) Creation ii) Insertion iii) Deletion iv) Traversal
3	Write a menu driven program that implements singly linked list for the following operations: Create, Display, Concate, Merge, Union, Intersection

4	Write a menu driven program that implements doubly linked list for the following operations: Create, Display, Count, Insert, Delete, Search, Copy, Reverse, Sort
5	Write a program to implement simple Stack, Queue, Circular Queue, Priority Queue
6	Write a menu driven program to a. Create a binary search tree b. Traverse the tree in Inorder, Preorder and Post Order c. Search the tree for a given node and delete the node
7	Write a program to implement insertion and deletion in AVL tree.
8	Write a program that implements Heap tree (Maximum and Minimum Heap tree) for the followingoperations. (Using array) Insert, Delete.
9	Write a program to implement Dijkstra's shortest path algorithm for a directed graph.
10	Write a program to insert and delete nodes in graph using adjacency matrix.
11	Write a program to implement Breadth First search using linked representation of graph.
12	Write a program to implement Depth first search using linked representation of graph.
13	Write a program to create a minimum spanning tree using Kruskal's algorithm.
14	Write a program to create a minimum spanning tree using Prim's algorithm.
15	Write a program to solve the 0/1 knapsack problem using dynamic programming.

Suggested Readings:

1. Gilles Brassard, Paul Bratley: Fundamentals of Algorithms, PHI Learning Pvt. Ltd, 2011
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest: Introduction to Algorithms, PHI Learning Pvt. Ltd,2009
3. Hubbard JR: Schaum's Outline of Data Structures with C++, Tata McGraw Hills, New Delhi, 2000.
4. Y.Langsam, M.J.Augenstein and A.M.Tanenbaum: Data Structures Using C and C++, Prentice Hall of India, 2015.

Reference Books:

1. Seymour Lipschutz, *Data Structures*, Tata McGraw-Hill, Schaum's Outlines, New Delhi.
2. Weiss, *Data Structures and Algorithm Analysis in C++*, Pearson Education.
3. Goodrich, *Data Structures and Algorithms in C++*, Wiley India Pvt. Ltd.
4. S. Sahni, Data structures, Algorithms, and Applications in C++, University Press (India) Pvt. Ltd.
5. Walter Savitch, Problem solving with C++, Pearson education.
6. John R. Hubbard, Data Structures with C++, Tata McGraw-Hill, Schaum's Outlines, New Delhi.

Useful Video Links:

Experiment No.	**Experiment Name**	**Links**
1	Sorting Algorithms: Bubble Sort and Selection Sort	https://archive.nptel.ac.in/courses/106/102/106102064/
2	Time and Space Complexity of Binary Search	https://www.youtube.com/watch?v=zWg7U0OEAoE
3	Prim's Algorithm	https://www.nptelvideos.com/lecture.php?id=5899
4	Depth-First Search (DFS)	https://www.nptelvideos.com/lecture.php?id=5893

Course Code	**BC-MCA-125A**				
Category	Bridge Course LAB				
Course Title	**Software Lab-Bridge Course**				
Scheme and Credits	L	T	P	**Credits**	**SEMESTER-I**
	0	0	8	**4**	
Course Objectives	The objectives of this course are to • Understand the Basics of Computer Systems, Operating Systems, and Computer Networks. • Develop Proficiency in Using Office Automation Tools and Enhancing Productivity. • Learn C Programming Fundamentals and Master Problem-Solving Techniques • Understand and Apply Object-Oriented Programming Concepts in C++ • Develop Advanced C++ Programming Skills with Inheritance, Polymorphism, and Exception Handling • Design and Implement Efficient Algorithms and Data Structures				
Internal Assessment	50 Marks				
External Practical	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Demonstrate the ability to apply programming logic and data handling techniques to solve real-world problems using C/C++.	Level 3: Apply
CO2	Break down complex problems into smaller parts and determine the most efficient approach to program design and data processing.	Level 4: Analyze
CO3	Critique and compare different methods of problem-solving, algorithm efficiency, and program functionality across various applications.	Level 5: Evaluate
CO4	Design and develop comprehensive software solutions, integrating various programming concepts and tools to meet user requirements.	Level 6: Create

List of Experiments

Sr. No.	**Contents**
1	Advanced Document Creation and Professional Formatting using MS Word
2	Data Analysis, Visualization, and Reporting using MS Excel
3	Designing and Delivering Interactive Presentations using MS PowerPoint
4	C Program to Compute Sum and Average of Numbers

5	C Program for Digit-wise Analysis of an Integer
6	C Program to Generate Prime Numbers
7	C Program to Check Armstrong Number
8	C Program to Calculate Factorial (Iterative Method)
9	C Program to Find GCD using Recursion
10	C Program to Find Largest and Smallest Elements
11	C++ Program for Multiplication Table
12	C++ Program to Find Factorial Using Recursive Function
13	C++ Program Demonstrating OOP Concepts
14	C++ Program for Sorting and Searching
15	C++ Program to Implement Stack using Arrays

Suggested Readings:

- Gill Nasib Singh: Computing Fundamentals and Programming in C, Khanna Books Publishing Co., New Delhi, 2015.
- Kenneth. A.: C problem solving and programming, Prentice Hall, 1990.
- E. Balaguruswamy: Programming in C, Tata McGraw Hill, 2019.
- E. Balaguruswamy: C++, Tata McGraw Hill Publications, 2020.
- Herbert Schildt: C++ - The Complete Reference, Tata McGraw Hill Publications,2017

Virtual Lab Links:

Experiment No.	**Experiment Name**	**Virtual Lab Links**
1	Recursive Function	https://www.nptelvideos.com/lecture.php?id=6643
2	Inheritance	https://archive.nptel.ac.in/courses/106/105/106105151/
3	Polymorphism	https://www.youtube.com/watch?v=N0iYriJWq94&t=566s
4	Sorting and Searching	https://www.nptelvideos.com/lecture.php?id=6976

Course Code	**EL-MCA-108A**				
Category	Experiential Learning				
Course Title	**Software Lab-3**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • Explore emerging database systems like mobile, multimedia, and GIS databases. • Master data warehousing and OLAP for effective data analysis and reporting.				
Assessment	50 Marks				
End Semester Practical Examination	50 Marks				
Total Marks	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Apply SQL commands to insert, update, delete records, and perform calculations on columns using arithmetic operations and SQL functions.	Level 3: Apply
CO2	Analyze the data using logical operators, BETWEEN, and aggregate functions such as COUNT and GROUP BY to group and filter records.	Level 4: Analyze
CO3	Evaluate the structure of SQL queries for data integrity and correctness, including proper use of joins, grouping, and ordering of records.	Level 5: Evaluate
CO4	Design and create views, implement constraints, and demonstrate effective transaction control to ensure database consistency and integrity.	Level 6: Create

List of Experiments

Sr. No.	**Contents**
1	Execute DDL, DML, DCL and TCL Commands.
2	Demonstrate the use of ORACLE operators • Arithmetic operators • Comparison operators • Logical operators
3	Demonstrate the use of DUAL table
4	Demonstrate the use of Data Constraints.
5	Execute Group by, Order by clause on Relations.
6	Demonstrate the use of ORACLE/SQL Server/DB functions • Aggregate functions • Numeric functions

	• String functions
7	Demonstrate pattern matching and range searching functions.
8	Demonstrate INTERSECTION, UNION and MINUS functions.
9	Execute Sub Queries and Co-Related Nested Queries on Relations.
10	Perform the following join operations a. Cross b. Inner c. Outer (left, right, full) d. Self
11	Demonstrate use of VIEWS in DBMS.
12	Write SQL commands to demonstrate transaction control using `ROLLBACK`, `COMMIT`, and `SAVEPOINT`.
13	Demonstrate the use of Date and timeconversion functions
14	Demonstrate the use of INDEX in DBMS
15	Demonstrate how PERMISSIONS are given on Database
16	Write a PL/SQL code block that will accept an account number from the user and debit anamount of Rs. 2000 from the account, If the account has a minimum balance of Rs.5000, after the amount is debited. The process is to be fired on the accounts table.
17	Write a PL/SQL code block to calculate the area of a circle for a value of radius varyingfrom 3 to 7. Store the radius and the Corresponding values of calculated area in a table.
18	Write a PL/SQL block that first insert a record in EMP table, update the salaries of John and Clark by Rs. 2000 andRs.1500 then check to see that the total salary does not exceed Rs.20000. If the total salary is greater thanRs.20000 then undo the Updates made to salaries of John and Clark.
19	Demonstrate the use of NOSQL Database.

Text Books:

1. RamezElmasri and Shamkant B. Navathe, *Fundamentals of Database Systems,* PearsonEducation, 2016
2. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, *Database System Concepts*, McGraw Hill Education, 2021
3. Ivan Bayross, *SQL, PL/SQL the Programming Language of Oracle,* BPB Publications, 2010.

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems,* McGraw Hill Higher Education, 2014
2. Doug Bierer, *MongoDB Quick Start Guide,* Packt Publishing, 2018

Useful Video Link:

Experiment No	Experiment Name	Links
1	Write SQL command to create a table with columns of your choice. Write an SQL command to add a new column to the table. Write an SQL command to delete the table from the database.	https://archive.nptel.ac.in/courses/106/106/106106220/
2	Write SQL command to insert a new record into the table. Write an SQL command to update a column value in the table. Write an SQL command to delete a record from the table.	https://archive.nptel.ac.in/courses/106/106/106106220/
3	Write SQL commands showcase the use `ROUND`, `COUNT`, `UPPER`, `SYSDATE`, and `TO_CHAR` functions	https://archive.nptel.ac.in/courses/106/106/106106220/
4	Write SQL command to perform an arithmetic calculation on numeric columns.	https://archive.nptel.ac.in/courses/106/106/106106220/
5	Write SQL command to find records that satisfy either of two conditions using logical operators.	https://archive.nptel.ac.in/courses/106/106/106106220/
6	Write SQL command to create a table with columns of your choice. Write an SQL command to add a new column to the table. Write an SQL command to delete the table from the database.	https://archive.nptel.ac.in/courses/106/106/106106220/

Course Code	**EL-MCA-110A**				
Category	Experiential Learning				
Course Title	**Software Lab-4**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • Understand basic concepts of Operating Systems and their structure. • Learn about concept of processes and process scheduling • Learn in detail about Deadlock, memory management and I/O management.				
Assessment	50 Marks				
End Semester Practical Examination	50 Marks				
Total Marks	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Implement object-oriented concepts such as inheritance, abstraction, interfaces, event handling, and graphics algorithms in Java and C/C++.	Level 3: Apply
CO2	Analyze and debug Java programs, algorithms for geometric transformations, and multi-threading applications for optimization and error resolution.	Level 4: Analyze
CO3	Evaluate the efficiency and functionality of matrix multiplication, event handling techniques, graphical algorithms, and multi-threading in Java and C/C++.	Level 5: Evaluate
CO4	Design and develop Java applications and C/C++ programs for graphical transformations, event-driven programming, and multi-threading with real-time functionality.	Level 6: Create

List of Experiments:

Sr. No.	**Contents**
1	To understand and run basic UNIX/LINUX commands
2	To study of Basic Unix/Linux Commands and various Unix/Linux editors such as vi, ed, ex and EMACS.
3	To study basic file manipulation commands of Unix/Linux commands
4	Analyze the performance of different scheduling algorithms.
5	Write a script to perform following basic math operations as (i) Addition (ii) Subtraction (iii) Multiplication (iv) Division Note: Take input from i) keyboard ii) command line arguments

6	Write shell script to show various system configurations like (i) Currently logged user and his long name (ii) Current shell (iii) Your home directory (iv) Your operating system type (v) Your current path setting (vi) Your current working directory (vii) Show all available shells
7	Write a script to convert the contents of a given file from uppercase to lowercase and also count the number of lines, words and characters of the resultant file. Also display the result in descending order.
8	Write a shell script to list the files arranged in descending order of their size.
9	Write a shell script to print the contents of a file from a given line number to next given line number.
10	Write a shell script to determine whether given file exists or not, file name is supplied as command line arguments, also check for sufficient number of command line arguments has been passed.
11	Write a shell script to check (i) File Existence (ii) File Permissions (iii) Check if file has execute permission, if not then changepermission of file and make it executable (iv) Check whether the file is sorted or not, if not then sort thefile (v) Read another file and compare the permissions of both the files, and extract Common permissions if any.
12	Write a shell script to check whether the given string is palindrome (i) without using string function (ii) with using string function
13	Write a shell script to calculate basic salary of Employee on the basis of following conditions: (a) if basic <10000, then hra=15% of basic and da=10% of basic (b) otherwise, hra=25% of basic and da=15% of basic
14	Write an interactive file handling shell program. Let it offer the user the choice of copying, removing, renaming or linking files. Once the use has made a choice, have the program ask the user for necessary information, such as the file name, new name and so on

Text Books:

1. Deitel, H.M., *An Introduction to Operating Systems*. Addison Wesley Publishing Company 1984.

2. Milenkovic, M., *Operating Systems - concepts and Design*, McGraw Hill International Edition Computer Science series 1992.

3. Galvin P., J.L., Abraham Silberschatz. *Operating System Concepts*, John Wiley & Sons Company, 1989.

4. Tanenbaum, A.S., *Modern Operating System*, Prentice Hall of India Pvt. Ltd.1995.

5. Mokhtar Ebrahim and Andrew Mallett, *Mastering Linux Shell Scripting*, Packt Publishing, 2nd ed. Edition 2018.

6. Love, R., *Linux System Programming*, O'Reilly Media, 2013.

7. Sobell, M. G., *A Practical Guide to Linux Commands, Editors, and Shell Programming*, Pearson 2017

Reference Books:

1. William Stallings, *Operating Systems*, Prentice Hall of India Pvt. Ltd.

2. Joshi R.C., *Operating System*, Wiley India.

3. Achyut S. Godbole*Operating Systems*, Tata McGraw Hill 2nd edition.

Useful Video Links:

Experiment No.	Experiment Name	Links
1	To understand and run basic UNIX/LINUX commands	https://www.youtube.com/watch?v=rRGCGZ6OHw8&t=612s
2	To study basic file manipulation commands of Unix/Linux commands	https://www.youtube.com/watch?v=Z0Vkrn9faoM&t=510s
3	Networking commands	https://www.youtube.com/watch?v=Z0RVnURLRZM&t=334s

Course Code	**EL-MCA-207A**				
Category	Experiential Learning				
Course Title	**Software Lab-5**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • To introduce the foundational concepts, history, and applications of Artificial Intelligence. • To develop an understanding of knowledge representation and reasoning techniques. • To explore computational intelligence methods such as genetic algorithms and neural networks. • To study fuzzy logic and neuro-fuzzy systems for decision-making under uncertainty.				
Internal Assessment	50 Marks				
External Practical	50 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	Recall fundamental definitions, concepts, and historical developments of AI, search algorithms, and intelligent systems covered throughout the course.	Level 3: Apply
CO2	Explain AI techniques like search, reasoning, and learning in solving real-world problems using examples from diverse application domains.	Level 4: Analyze
CO3	Apply AI algorithms such as A, DFS, BFS, and game strategies to solve structured and unstructured problem scenarios practically.	Level 5: Evaluate
CO4	Analyze AI problem types and compare performance of algorithms for games, puzzles, optimization, and decision-making tasks.	Level 6: Create

List of Experiments

Sr. No.	Contents
1	Assume you travel 80 km to and fro in a day. Fuel Cost is INR 80 per liter and your vehicle's Fuel Average is 18 km/litre. Write a Python program to calculate the Driving Cost per day.
2	Write a Python program which iterates the integers from 1 to 30 (included). if number isdivisible by 3 print "GITAM", if number is divisible by 5 print "DCA". If number is divisible by both 3 and 5 print "GITAM & DCA" and otherwise print the number itself.
3	Write a Python program to display the following pattern for the given input of no. of lines. 1 121

	12321 1234321.
4	Write a program to check whether the given integer number is Palindrome or not.
5	Assuming your weight in kilogram and height in meters, calculate your Body Mass Index (BMI) value using the formula BMI=weight/(height*height) Height is given in (feet.inches) form and weight is given in kgs and to convert total height in meters consider 1 Feet = 0.3048 meter and 1 Inch = 0.0254 meter
6	Create a list of city names from the given list where city name contains substring 'pur' cities=['Jaipur','Ambala','Nagpur','Kanpur','Karnal','Sholapur'].
7	Book order is given as list of sublists with the following items Order Number Book Title Author Quantity Unit Price 34587 Learning Python Mark Lutz 440.95 98762 Programming Python Mark Lutz 556.80 77226 Head First Python Paul Barry 332.95 Write a Python program to generate the Order summary in this List of tuple form [('34587', 163.8), ('98762', 284.0), ('77226', 108.85)] Where first item in the tuple is Order Number, second item is Net Price i.e. Quantity*Unit Price if Net Price < 100.00 it should be increased by Rs. 10.
8	A string is given to you e.g. "aabaacdaadd". Create a dictionary of each character in the given string and its frequency, i.e. output={'a': 6, 'b': 1, 'c': 1, 'd': 3}
9	Write a Recursive function to generate n terms of a Fibonacci Series 0,1,1,2,3,5,8,13,...
10	Write a Python program to implement multiple inheritance.
11	Write a Python program to handle 'ZeroDivisionError' exception.

Text Books:

1. E. Balagurusamy, *Introduction to Computing and Problem Solving Using Python*, McGrawHill Education, 2017
2. YashavantKanetkar, Aditya Kanetkar, *Let us Python*, BPB Publications, 2020
3. VamsiKurama, *Python Programming: A Modern Approach*, Pearson Education, 2017
4. SheetalTaneja, Naveen Kumar, *Python Programming A Modular Approach*, Pearson, 2017
5. Rao R. Nageswara ,*Core Python Programming*, Dream Tech, New Delhi, 2018

Reference Books:

1. Mark Lutz, *Learning Python*, 5th edition, O'Reilly, 2017.
2. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, Shroff/O'Reilly, 2016.
3. Wes McKinney**,** *Python for Data Analysis*, O'Reilly, 2022
4. Eric Matthes, *Python: Crash Course A Hands-On, Project-Based Introduction to Programming*, No Starch Press, San Francisco, 2019
5. Martin C. Brown, *Python: The Complete Reference*, McGraw-Hill, 2018

Useful Video links:

Unit No.	Topics	Links
Unit-I	Introduction to Artificial Intelligence	https://youtu.be/GHpchgLoDvI?si=YupehJ9mqMxeHHaL
Unit-II	Knowledge &Its Representation	https://youtu.be/zT0sGjOSPt8?si=aPh-4h591rWIzgPO
Unit-III	Computational Intelligence	https://youtu.be/XCPZBD9lbVo?si=Cvu36ZDVeM8a1k0S
Unit-IV	Fuzzy Systems	https://youtu.be/K7S3TgfqnX0?si=QZXSnDjodoEJcv3d

Course Code	**EL-MCA-209A**				
Category	Experiential Learning				
Course Title	**Software Lab-6**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • Understand fundamental web technologies including HTML, CSS, JavaScript, XML, and server-side scripting for static and dynamic web development. • Develop web applications using client-server architecture, enhancing interactivity and data handling through JavaScript, JSP, and Servlets. • Apply web design principles to create responsive, user-friendly interfaces and structured web documents using HTML and CSS. • Implement data validation, session management, and database connectivity in web applications using JavaScript, JSP, and backend programming techniques.				
Internal Assessment	50 Marks				
External Practical	50 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Develop interactive web pages using HTML forms, JavaScript validation, and CSS styling to create responsive and usable interfaces.	Level 3: Apply
CO2	Compare client-side scripting with server-side technologies to identify appropriate use cases in full-stack web application development.	Level 4: Analyze
CO3	Assess the effectiveness of web pages and applications based on usability, structure, functionality, and adherence to web standards.	Level 5: Evaluate
CO4	Design and build a complete static and dynamic web application integrating front-end and back-end components using taught technologies.	Level 6: Create

List of Experiments

Sr. No.	**Contents**
1	Create a basic HTML5 web page that includes text, images, and links.
2	Write a HTML program for demonstrating Hyperlinks. • Navigation from one page to another. • Navigation within the page

3	Design a multimedia-rich HTML5 web page incorporating audio, video, and graphics.
4	Write a HTML program to develop a static Home Page using frames. • Write a HTML program to develop a static Registration Form. • Write a HTML program to develop a static Login Page
5	Write a HTML program to develop a static Web Page for Catalog. • Write a HTML program to develop a static Web Page for Shopping Cart.
6	Utilize CSS 3.0 properties to enhance an HTML5 web page with borders, backgrounds, fonts, and text effects.
7	Write a javascript program to validate USER LOGIN page.
8	Write a java script program for validating REGISTRATION FORM
9	Create a JavaScript program to manipulate the DOM and update web page content dynamically.
10	Implement JavaScript event handling to manage user interactions such as mouse clicks and keyboard events.
11	Create a JavaScript program to manage cookies and demonstrate their use in maintaining user sessions.
12	Install and configure MySQL and PHP on a local server, following security best practices.
13	Develop a PHP script to connect to a MySQL database, perform CRUD operations, and display results on a webpage.
14	Create a dynamic PHP web page that uses sessions and cookies to track user activity.
15	Build a simple AJAX application that retrieves data from a server and updates the webpage without reloading.
16	Develop an AJAX-based form that submits data to a server-side PHP script and displays the response dynamically.
17	Implement a secure AJAX application that handles user authentication and data access.
18	Create an accessible rich internet application using AJAX and PHP, ensuring compatibility with assistive technologies.

Suggested Readings:

1. Deitel H.M., Deitel P.J., Internet & World wide Web: How to program, Pearson Education.
2. Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.
3. Boronczyk, Naramore, Beginning PHP, Apache, MySQL Web Development, Wiley India Pvt.Ltd.
4. Thomas Powell, Ajax: The Complete Reference, McGraw Hill.

Reference Books:

1. 1. Boronczyk, Naramore, *Beginning PHP, Apache, MySQL Web Development*, Wiley India Pvt.Ltd.
2. 2. Thomas Powell, Ajax: *The Complete Reference Book*.

Useful Video links:

Unit No.	Topics	Links
1.	INTRODUCTION OF WEB BROWSER,HTML, CSS	https://www.youtube.com/live/AnD2xH72jHg?feature=shared
2.	Java script	https://www.nptelvideos.com/video.php?id=2352&c=6
3.	PHP	https://youtu.be/OQ14NjbEXJM?feature=shared
4.	INTRODUCTION TO AJAX	https://youtu.be/XdXbDw7LwBE?feature=shared

Course Code	**EL-MCA-208A**				
Category	Experiential Learning				
Course Title	**Software Lab-7**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • Understand .NET Framework fundamentals and develop basic applications using VB.NET and C# programming languages. • Implement object-oriented concepts like constructors, interfaces, overloading, and overriding in VB.NET programs. • Utilize advanced data structures such as jagged arrays, array lists, and hash tables in .NET. • Develop database connectivity and web applications using ADO.NET and ASP.NET with practical coding skills.				
Internal Assessment	50 Marks				
External Practical	50 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	Develop VB.NET and C# programs for calculator, array handling, collections, delegates, events, and database connectivity using ADO.NET.	Level 3: Apply
CO2	Analyze code behavior involving overloading, overriding, jagged arrays, hash tables, and event-driven programming in .NET applications.	Level 4: Analyze
CO3	Evaluate the design and implementation of user interface-driven database connectivity and web form applications in ASP.NET.	Level 5: Evaluate
CO4	Design and build efficient .NET applications integrating GUI, collections, delegates, events, and database connectivity using ADO.NET and ASP.NET.	Level 6: Create

List of Experiments

Sr. No.	Contents
1	Introduction to .NET Framework.
2	Write a program to display message in VB.net using message Box. Write a program to display message in C# using message Box.
3	Write a program to implement multilevel inheritance. Accept and display data for one student. Class student, Data Members: Roll_no , name Class Test,Data Members : marks1 , marks2 Class Result,Data Members : total.
4	Consider the Database STUDENT consisting of following tables: tbl_Course

	(CourseID:int, CourseName: string) tbl_Student (USN: string, StudName: string, Address: string,CourseID: int, YrOfAdmsn: int) Develop suitable windows application using C#.NET having following options: a) Entering new course details. b) Entering new student details. c)Display the details of students (in a Grid) who belong to a particular course. d)Display the details the students who have taken admission in a particular year
5	Create the application using ASP.NET Server controls that accepts name, password, age, email id, and user id. All the information entry is compulsory. Password should be reconfirmed. Age should be within 21 to 30. Email id should be valid. User id should have at least a capital letter and digit as well as length should be between 7 and 20 characters.
6	Create a web application to insert 3 records inside the SQL database table having following fields (DeptId, DeptName, EmpName, Salary). Update the salary for any one employee and increment it to 15% of the present salary. Perform delete operation on 1 row of the database table.
7	Consider the Database STUDENT consisting of following tables: tbl_Course (CourseID:int, CourseName: string) tbl_Book (BookID :int, BookTitle: string, Author: string, CourseID: int) tbl_Student (USN: string, StudName: string, CourseID: int) tbl_BookIssue(USN: string, BookID: int, IssueDate: Date) Develop suitable windows application using .NET having following options: a) New Course Entry, b) New Book Entry, c)New Student Entry d) Issue of books to a student, e) Generate report (display in a grid) showing all the books belonging to particular course. f) Generate report (display in a grid) showing all the books issued on a particular date. g)Generate report (display in a grid) showing all the books issued to a particular student.
8	Develop a Web Application using C#.NET and ASP.NET for a Bank. The BANK Database should consist of following tables: a) tbl_Bank (BankID: int, BankName: string), b) tbl_Branch (BranchID: int, BankID: int, BranchName: string) c) tbl_Account (AccountNo:int, BankID: int, BranchID: int, CustomerName: string, Address: string, ContactNo: int, Balance: real) (Note: AccountNo and BankID together is a composite primary key). The master page of this web application should contain hyperlinks to New Bank Entry, New Branch Entry (of selected Bank), New Customer Entry (based on branch and bank) and Report Generation. The hyperlinks should navigate to respective content pages. These content pages provide the fields for respective data entry. The reports should be generated (display in grid) as below: a. Display all records of particular bank. b. Display all records of a branch of particular bank. c. The balance should be displayed for the entered account number (Bank and Branch are input through ComboBox controls and Account number is input through TextBox).

9	Write a program to demonstrate ado connectivity viva coding in asp.net.
10	Write a program to demonstrate asp.net Web form.
11	Write a program to implement GridView Data Display with ADO.NET in ASP.NET.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Client-Side vs. Server-Side Programming	https://www.youtube.com/watch?v=XlryaovT_3k
Unit-II	Inheritance	https://www.youtube.com/watch?v=PaqAhlb5XVw&list=PLLy_2iUCG87Ah844iZW3w3nzWSTA8KSZA&index=14
Unit-III	Using Dataset Objects and Updating Data Binding	https://www.youtube.com/watch?v=meWQLWq7QSE
Unit-IV	State Management, Web Services	https://www.youtube.com/watch?v=Ho2bpbqpkiM

Course Code	**EL-MCA-210A**				
Category	Experiential Learning				
Course Title	**Software Lab-8**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • Develop problem-solving skills using Python for algorithms like GCD, power, and square root calculations. • Implement and analyze fundamental search algorithms including linear and binary search techniques. • Design and apply sorting algorithms such as selection, insertion, and merge sort efficiently. • Create Python programs to generate prime numbers and manipulate lists for algorithmic practice.				
Internal Assessment	50 Marks				
External Practical	50 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	Implement algorithms in Python for computing GCD, square roots, powers, searching, sorting, and prime number generation.	Level 3: Apply
CO2	Analyze algorithm efficiency and correctness for searching, sorting, and numerical methods within computational problem contexts.	Level 4: Analyze
CO3	Evaluate different algorithmic approaches and their performance trade-offs in solving computational problems effectively.	Level 5: Evaluate
CO4	Design and develop efficient Python programs to solve real-world computational problems using appropriate algorithms and data structures.	Level 6: Create

List of Experiments

Sr. No.	Contents
1	Write a Program in Python to Compute the GCD of two numbers.
2	Write a program to perform different arithmetic operations on numbers in python
3	Write a program to create, concatenate and print a string and accessing a sub string from a given string
4	Write a program to create, append and remove lists in python
5	a) Write a python program to print the first half values in one line and the last half values in one line from the given list . b) Write a python program to check whether a given key already exists in a dictionary
6	Write a python program to find the factorial of a given number using recursive function.

7	a) Write a program to create a class to implement pow (x,n) . b) Create a class to convert integer to a roman numeral
8	Create a python program to demonstrate the concept of inheritance.
9	Write a python program to count the frequency of characters in a given file
10	Write a python program to print the current date in the following format "Sun May 29 02: 26:23 IST 2020 ".
11	Write a python program to create a small GUI application for insert, update and delete in a table using Oracle as back end and front end for creating form.
12	Write a program to Compare selection vs insertion sort on same dataset

Useful Video Links:

Unit No.	**Topics**	**Links**
Unit-I	Machine Learning	https://www.youtube.com/watch?v=r4sgKrRL2Ys&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77
	Supervised Learning	https://www.youtube.com/watch?v=OTAR0kT1swg&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=3
Unit-II	Unsupervised Learning	https://www.youtube.com/watch?v=NhimXdFenrg
	Reinforcement Learning	https://www.youtube.com/watch?v=ewkm38skUlY&list=PLEAYkSg4uSQ0Hkv_1LHlJtC_wqwVu6RQX
Unit-III	Introduction to Python	https://www.youtube.com/watch?v=eoPsX7MKfe8&list=PLIdgECt554OVFKXRpo_kuI0XpUQKk0ycO
Unit-IV	2D & 3D Data Visualization	https://www.youtube.com/watch?v=eFByJkA3ti4

Course Code	**RR-MCA-112A**				
Category	Research Report				
Course Title	**Industry Internship Report/ Project Report/Dissertation–I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • Develop effective project planning and management skills. • Enhance technical skills in software development, database design, and system integration. • Apply problem-solving techniques to address technical challenges. • Improve written and oral communication skills. • Understand and apply ethical principles in software development.				
Assessment	50 Marks				
End Semester Examination	50 Marks				
Total Marks	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify various technologies and fields for practical training.
CO2	Understand the process to make reports and presentation.
CO3	Applying engineering knowledge to solve industrial problems.
CO4	Analyze ethical practices and tools used in different technologies
CO5	Evaluate the performance on parameters such as communication skills, technical knowledge.
CO6	Design and develop the skills to make software/hardware, related to industrial training.

Overview:

MCA Dissertation-I is a foundational course that introduces students to the research process in computer science and information technology. This course provides students with the necessary skills and knowledge to undertake independent research projects. Students will learn to identify research problems, conduct literature reviews, design research methodologies, collect and analyze data, and present their findings effectively.

General Guidelines:

Project Selection	Choose a project that is relevant to the field of computer science and information technology. Ensure that the project is feasible and achievable within the given timeframe. Consult with the supervisor to refine the project scope and objectives.
Approval Process	The selected project must be approved by the faculty members/committee appointed by the Head of Department.
Presentation Guidelines	Each student will have 30-40 minutes for their presentation, followed by 5 minutes for Q&A.
Evaluation	The presentation will be evaluated by a committee constituted by the Head of Department. The evaluation will be based on:

Rubrics for Project Report/Dissertation–I

Sr. No.	Exam Type	Stage No.	Criteria	Assessment	Marks	Overall Weightage
1	**Internal**	**Stage-I**	Project Synopsis	Rubric I	25	Stage I to II = 50%
2		**Stage-II**	Presentation–I	Rubric II	25	
3	External/End Semester Exam	**Stage-III**	Project Understanding & Technical Knowledge (10 Marks)	Rubric III	50	Stage IV = 50%
			Methodology & Design Approach (10Marks)			
			Implementation Progress & Demonstration (10 Marks)			
			Innovation & Problem Solving (10 Marks)			
			Viva–Voce & Technical Skills(10 Marks)			
Total					100	100%

Rubric I: Project Synopsis (Stage-I)					
Parameters/Assessment Levels	**Excellent (05-04 Marks)**	**Good (03 Marks)**	**Average (02 Marks)**	**Poor (01-00 Marks)**	**Marks**
Project Definition & Problem Identification (05 Marks)	Problem, objectives and scope are clearly defined.	Problem and objectives are adequately defined.	Limited clarity in problem definition.	Problem is unclear or poorly defined.	
Literature Review (05 Marks)	Comprehensive review using relevant and credible references.	Adequate review with relevant references.	Limited review with few references.	Inadequate or irrelevant references.	
Technical & Domain Understanding (05	Demonstrates strong domain	Demonstrates good	Demonstrates basic	Demonstrates poor	

Marks)	and technical understanding.	understanding with minor gaps.	understanding.	understanding.	
Impact on Society & Relevance to POs/PSOs (05 Marks)	Strong societal/technical relevance with clear alignment.	Reasonable relevance and alignment.	Limited relevance or alignment.	No clear relevance or alignment.	
Presentation & Communication (05 Marks)	Clear, organized, and professional presentation.	Satisfactory presentation with acceptable clarity.	Presentation lacks clarity.	Poorly organized presentation.	

Rubric II: Presentation -I (Stage-II)

Sr. No.	Parameters/Assessment Levels	Excellent (05-04 Marks)	Good (03 Marks)	Average (02 Marks)	Poor (01-00 Marks)	Marks
1	**Problem Understanding & Planning (05 Marks)**	Problem, objectives, and planning are clearly defined.	Adequate understanding and planning.	Limited planning and clarity.	Poor understanding and planning.	
2	**Design Methodology & Feasibility (05 Marks)**	Methodology is justified and technically feasible.	Methodology is appropriate with acceptable feasibility.	Methodology is partially defined.	Methodology lacks clarity or feasibility.	
3	**Implementation Strategy & Timeline (05 Marks)**	Implementation plan and timeline are clearly defined.	Implementation strategy is satisfactory.	Limited implementation planning.	Implementation strategy is unclear.	
4	**Preliminary Progress & Requirement Fulfillment (05 Marks)**	Significant progress aligned with objectives.	Moderate progress toward objectives.	Limited progress achieved.	Minimal or no progress demonstrated.	
5	**Technical Presentation &Communication (05 Marks)**	Presentation is technically sound and professional.	Presentation is satisfactory.	Presentation lacks clarity.	Presentation is ineffective.	

Rubric III: External/End Semester Exam (Stage-III)						
Sr. No.	**Parameters / Assessment Levels**	**Excellent (05-04 Marks)**	**Good (03 Marks)**	**Average (02 Marks)**	**Poor (01-00 Marks)**	**Marks**
1	**Project Understanding & Technical Knowledge (10 Marks)**	Excellent understanding of concepts, methodology, and technical aspects.	Good understanding with reasonable clarity.	Satisfactory understanding with limited clarity.	Poor understanding of project concepts.	
2	**Methodology & Design Approach (10 Marks)**	Methodologies are clearly justified and technically sound.	Methodology is appropriate with minor refinements needed.	Methodology is partially defined.	Methodology lacks clarity.	
3	**Implementation Progress & Demonstration (10 Marks)**	Significant implementation progress demonstrated effectively.	Moderate progress with acceptable demonstration.	Limited implementation progress.	Minimal or no implementation progress.	
4	**Innovation & Problem Solving (10 Marks)**	Strong innovation and effective problem-solving approach.	Good innovation with acceptable problem-solving.	Limited innovation or analytical thinking.	Lacks innovation and problem-solving approach.	
5	**Viva–Voce (10 Marks)**	Answers confidently with technical justification.	Answers most questions satisfactorily.	Partial responses with basic understanding.	Unable to answer satisfactorily.	

Course Code	**RR-MCA-212A**				
Category	Research Report				
Course Title	**Industry Internship Report/ Project Report/Dissertation–II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	6	**3**	
Course Objectives	The objectives of this course are to • Develop project planning and management skills for successful technical execution. • Enhance software development, database design, and system integration capabilities. • Apply structured problem-solving methods to resolve complex technical issues. • Improve professional communication skills, both written and verbal. • Understand and apply ethical principles in software engineering practices.				
Assessment	50 Marks				
End Semester Examination	50 Marks				
Total Marks	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Identify emerging technologies and interdisciplinary fields for hands-on industrial training.	Level 1: Remember
CO2	Demonstrate report writing and presentation skills in technical and industrial contexts.	Level 2: Understand
CO3	Apply engineering principles to analyze and solve real-world industrial problems.	Level 3: Apply
CO4	Assess ethical standards and tools across diverse technological domains.	Level 4: Analyze
CO5	Evaluate personal performance in communication, teamwork, and technical proficiency.	Level 5: Evaluate
CO6	Design and develop industry-relevant software or hardware systems.	Level 6: Create

Overview:

MCA Dissertation-I is a foundational course that introduces students to the research process in computer science and information technology. This course provides students with the necessary skills and knowledge to undertake independent research projects. Students will learn to identify research problems, conduct literature reviews, design research methodologies, collect and analyse data, and present their findings effectively.

Rubrics for Industry Internship Report/ Project Report/Dissertation–II

Sr. No.	Exam Type	Stage No.	Criteria	Assessment	Marks	Overall Weightage
1	Internal	Stage-I	Project Synopsis	Rubric I	12.5	Stage I to III = 50%
2		Stage-II	Presentation -I	Rubric II	12.5	
3		Stage-III	Presentation -II	Rubric III	12.5	
4		Stage-IV	Project Report Evaluation	Rubric IV	12.5	
5	External/End SemesterExam	Stage-V	Project Understanding & Technical Knowledge (10 Marks)	Rubric V	50	Stage IV = 50%
			Demonstration & Working Model (10 Marks)			
			Demonstration & Working Model (10 Marks)			
			Report Quality & Documentation (10 Marks)			
			Viva–Voce & Response to Questions (10 Marks)			
Total					100	100%

Rubric I: Project Synopsis (Stage-I)					
Parameters/Assessment Levels	**Excellent** (2.5 Marks)	**Good** (2.0 Marks)	**Average** (1.5 - 1.0 Marks)	**Poor** (0.5 - 0.0 Marks)	**Marks**
Project Title & Problem Definition (2.5 Marks)	Project title is clear, relevant, and supported by a well-defined problem statement with clear objectives.	Project title and problem statement are relevant with acceptable clarity.	Project title/problem statement shows limited clarity and relevance.	Project title is unclear and problem statement is poorly defined.	
Literature Review (2.5 Marks)	Comprehensive literature review using relevant and credible sources.	Adequate literature review with relevant references.	Limited literature review with few references	Inadequate literature review with minimal or irrelevant references.	

Technical & Domain Understanding (2.5 Marks)	Demonstrates strong domain knowledge and excellent technical understanding of the proposed work.	Demonstrates good domain knowledge with acceptable technical understanding.	Demonstrates basic understanding with limited technical clarity.	Demonstrates poor domain knowledge and inadequate technical understanding.	
Relevance to Society, SDGs and POs/PSOs (2.5 Marks)	Project shows strong societal/industrial relevance with clear alignment to SDGs and POs/PSOs.	Project demonstrates reasonable alignment to SDGs and POs/PSOs.	Project shows limited relevance or partial alignment to SDGs and POs/PSOs.	Project lacks relevance and alignment to SDGs and POs/PSOs.	
Presentation & Communication (2.5 Marks)	Synopsis is well-organized, professionally presented, and communicated effectively with confidence.	Presentation is organized with satisfactory communication and clarity.	Presentation is acceptable but lacks clarity or organization.	Presentation is poorly organized and ineffective.	

Rubric II: Presentation -I (Stage-II)						
Sr. No.	**Parameters/Assessment Levels**	**Excellent** (2.5 Marks)	**Good** (2.0 Marks)	**Average** (1.5 - 1.0 Marks)	**Poor** (0.5 - 0.0 Marks)	**Marks**
1	**Problem Understanding & Planning (2.5 Marks)**	Demonstrates clear understanding of the problem with well-defined objectives, scope, and systematic planning.	Demonstrates acceptable understanding with moderate planning and clarity.	Demonstrates limited understanding with partially defined planning.	Demonstrates poor understanding and inadequate planning.	
2	**Design Methodology & Feasibility (2.5 Marks)**	Appropriate methodology is selected with clear justification, feasibility, and technical relevance.	Methodology is appropriate with moderate justification and feasibility.	Methodology is partially defined with limited justification.	Methodology is unclear or lacks technical feasibility.	

3	**Implementation Strategy & Progress (2.5 Marks)**	Implementation plan, timeline, and project progress are clearly defined and effectively executed.	Implementation strategy and progress are satisfactory with minor gaps.	Implementation progress is partial with limited execution clarity.	Implementation strategy and progress are poorly defined.	
4	**Project Functionality & Requirement Fulfillment (2.5 Marks)**	Project demonstrates expected functionality and effectively meets defined objectives/requirements.	Project functions satisfactorily and meets most requirements.	Project partially functions with limited requirement fulfillment.	Project fails to demonstrate expected functionality or requirements.	
5	**Presentation & Communication (2.5 Marks)**	Presentation is well-organized, technically sounds and communicated confidently and professionally.	Presentation is organized with acceptable technical communication.	Presentation is adequate but lacks clarity or confidence.	Presentation is poorly organized and ineffective.	

Rubric III: Presentation -II (Stage-III)						
Sr. No.	**Parameters/Assessment Levels**	**Excellent** (2.5 Marks)	**Good** (2.0 Marks)	**Average** (1.5 - 1.0 Marks)	**Poor** (0.5 - 0.0 Marks)	**Marks**
1	**Project Progress & Implementation (2.5 Marks)**	Implementation is completed systematically with clear progress.	Implementation is satisfactory with minor gaps.	Partial implementation with limited progress.	Implementation is incomplete or unclear.	
2	**Technical Execution & Methodology (2.5 Marks)**	Methodology and technical execution are accurate and well justified.	Technical execution is satisfactory with acceptable methodology.	Limited technical execution and methodology.	Technical execution is weak or poorly defined.	
3	**Results & Outcomes (2.5 Marks)**	Results are clearly presented and aligned with objectives.	Results are satisfactory with acceptable outcome achievement.	Limited results with partial outcome achievement.	Results are unclear or objectives are not achieved.	

4	**Project Functionality & Requirement Fulfillment (2.5 Marks)**	Project effectively functions and meets defined requirements/objectives.	Project meets most requirements with satisfactory functionality.	Project partially meets requirements.	Project fails to meet expected requirements.	
5	**Presentation & Technical Communication (2.5 Marks)**	Presentation is clear, organized, and technically sound.	Presentation is satisfactory with acceptable clarity.	Presentation lacks clarity or organization.	Presentation is poorly organized and ineffective.	

Rubric IV: Project Report Evaluation (Stage-IV)						
Sr. No.	**Parameters / Assessment Levels**	**Excellent (12.5-10.00 Marks)**	**Good (9.5-7.5 Marks)**	**Average (06-04 Marks)**	**Poor (04–00 Marks)**	**Marks**
1	**Project Report & Publication (12.5 Marks)**	Report is well-structured, technically sound, properly formatted with references and supported by publication in peer-reviewed journals/conferences.	Report is adequately documented with acceptable formatting and references, supported by publication/presentation in conferences.	Report is partially documented with limited technical clarity, formatting issues, or minimal publication contribution.	Report lacks proper documentation, formatting references, and no publication.	

Rubric V: External/End Semester Exam (Stage-V)						
Sr. No.	**Parameters / Assessment Levels**	**Excellent (10–08 Marks)**	**Good (07-05 Marks)**	**Average (04–02 Marks)**	**Poor (02–00 Marks)**	**Marks**
1	**Project Understanding & Technical Knowledge (10 Marks)**	Demonstrates excellent understanding of project concepts, methodology, and technical implementation.	Demonstrates good understanding with minor conceptual knowledge.	Demonstrates satisfactory understanding with limited technical clarity.	Demonstrates poor understanding of project concepts and implementation.	
2	**Innovation &**	Project	Project	Project	Project lacks	

	Problem Solving (10 Marks)	demonstrates strong innovation, creativity and effective problem-solving approach.	demonstrates good innovation with acceptable problem-solving ability.	demonstrates limited innovation and moderate problem-solving ability.	innovation and effective problem-solving approach.	
3	**Project Functionality & Demonstration (10 Marks)**	Project functions accurately and is demonstrated effectively with clear explanation of outcomes.	Project functions satisfactorily with good demonstration and explanation.	Project partially functions with limited demonstration effectiveness.	Project does not function properly or demonstration is ineffective.	
4	**Quality of Project Report (10 Marks)**	Report is professionally prepared with proper formatting, technical depth and references.	Report is well-prepared with minor formatting or documentation issues.	Report is satisfactory with limited technical clarity or documentation gaps.	Report lacks proper formatting, technical depth, and documentation.	
5	**Viva–Voce & Technical Response (10 Marks)**	Answers questions confidently with accurate technical justification and analytical thinking.	Answers most questions correctly with good technical understanding.	Answers questions partially with basic technical understanding.	Unable to answer questions satisfactorily and demonstrates weak understanding.	

Table 3.4.1.2: Rubrics for PT Evaluation

Marks Obtained (%)	Grade	Performance Level
81 – 100	A	Excellent

Exam Type	Criteria	Assessment	Marks	Assessment Weightage
Internal	Preparation of PPTs	Rubric I	25	100%
	Seminar/Presentation Skills	Rubric II	25	
	Viva-Voce	Rubric III	25	
	Report	Rubric IV	25	
Total			100	100%

61 – 80	B	Good
41 – 60	C	Satisfactory
Below 40	F	Not Satisfactory

Note: 1 Student awarded 'F' Grade is required to repeat the Practical Training.
2 Each student has to undergo practical training of 4-6 weeks during summer vacations after 4th and 6th semester and its evaluation shall be carried out in 5th and 7th semester respectively**.**

Rubric for Evaluation of Industrial Training/PT

Table 3.4.1.3: Rubric I: Preparation of PPTs

Parameters/Marks	Good (05-04 Marks)	Average (03-02 Marks)	Poor (01-00 Marks)
Slide Organization (05 Marks)	Slides are well-organized with a proper sequence.	Slides are moderately organized with minor flow issues.	Slides are poorly organized and lack logical flow.
Font, Color & Layout (05 Marks)	Fonts, colors, and background enhance readability and presentation.	Minor readability or formatting issues are present.	Poor font, color, or layout reduces readability.
Images & Visuals (05 Marks)	Images and graphics are relevant and effectively support the content.	Some visuals are relevant but lack consistency or clarity.	Visuals are irrelevant, unclear, or poorly used.
Content Clarity (05 Marks)	Content is clear, concise, and effectively presented.	Content is understandable with minor clarity issues.	Content is unclear, lengthy, or poorly presented.

Technical Accuracy (05 Marks)	Content is technically correct and relevant to the topic.	Content has minor technical inaccuracies.	Content contains major technical errors or irrelevant information.

Table 3.4.1.4: Rubric II: Seminar/Presentation Skills

Parameters/Marks	**Good (05-04 Marks)**	**Average (03-02 Marks)**	**Poor (01-00 Marks)**
Subject Knowledge (05 Marks)	Demonstrates strong understanding with clear and confident explanation of the topic.	Demonstrates adequate understanding with acceptable explanation.	Demonstrates limited understanding and unclear explanation.
Communication Skills (05 Marks)	Communicates clearly with appropriate vocabulary, confidence, and pronunciation.	Communication is understandable with minor fluency or pronunciation issues.	Communication lacks clarity with poor fluency and vocabulary.
Presentation & Interaction Skills (05 Marks)	Maintains good interaction, confidence, and minimal dependence on slides.	Maintains moderate interaction with occasional dependence on slides.	Limited interaction and excessive reading from slides.
Time Management (05 Marks)	Presentation is well-paced and completed effectively within the allotted time.	Minor deviation in timing with moderate pacing issues.	Poor time management affects presentation quality.
Response to Questions (05 Marks)	Answers questions accurately with confidence and technical justification.	Answers most questions adequately with partial justification.	Unable to answer questions satisfactorily.

Table 3.4.1.5: Rubric III: Viva-Voce

Parameters/Marks	**Good (05-04 Marks)**	**Average (03-02 Marks)**	**Poor (01-00 Marks)**
Subject Knowledge (05 Marks)	Demonstrates good understanding of the subject with clear conceptual knowledge.	Demonstrates adequate understanding with minor conceptual gaps.	Demonstrates limited understanding of the subject.
Technical Understanding (05 Marks)	Explains technical concepts and processes clearly and accurately.	Explains most technical concepts with moderate clarity.	Unable to explain technical concepts clearly.

Response to Questions (05 Marks)	Answers questions confidently with proper justification.	Answers most questions adequately with partial justification.	Unable to answer questions satisfactorily.
Analytical & Problem-Solving Ability (05 Marks)	Demonstrates good analytical thinking and problem-solving approach.	Demonstrates moderate analytical ability.	Demonstrates limited analytical and problem-solving ability.
Confidence & Communication (05 Marks)	Responds confidently with clear and effective communication.	Demonstrates moderate confidence with acceptable communication.	Lacks confidence and communication clarity.

Table 3.4.1.6: Rubric IV: Report

Parameters/Marks	**Good (05-04 Marks)**	**Average (03-02 Marks)**	**Poor (01-00 Marks)**
Organization of Content (05 Marks)	Report is systematically organized and consistently presented.	Report is adequately structured with minor inconsistencies.	Report lacks proper structure and organization.
Formatting & Presentation (05 Marks)	Formatting, headings, captions, and layout are consistent and professional.	Minor formatting inconsistencies are present.	Formatting is inconsistent and poorly maintained.
Technical Content & Clarity (05 Marks)	Technical content is relevant, clear, and effectively explained.	Technical content is adequate with minor clarity issues.	Technical content lacks clarity and relevance.
Figures, Tables & Visual Quality (05 Marks)	Figures and tables are relevant, properly labeled, and support the report effectively.	Most figures and tables are relevant with minor presentation issues.	Figures and tables are unclear, irrelevant, or poorly presented.
References & Documentation (05 Marks)	References and documentation are properly cited and well maintained.	References and documentation are adequate with minor issues.	References and documentation are incomplete or poorly maintained.

All records and documentation are maintained for verification purposes.

Annexure AC/5.39

Annexure 4.4

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT,
KABLANA (JHAJJAR)
An Autonomous Institute (UGC)
Approved by AICTE, New Delhi and Affiliated to MDU, Rohtak
NAAC 'A' GRADE

Scheme of Studies and Examination
Bachelor of Computer Applications

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1Tutorial (T) per week	1 Credit
3	1 Practical (P) per week	0.5 Credit
4	2 Practical (Lab) per week	1 Credit

2. RANGE OF CREDIT

A range of credits from136 to144 for a student to be eligible to get Under Graduate degree in Computer Application. A student will be eligible to get Under Graduate degree with Honours or Research Program, if he/she completes an additional 48 credits.

3. STRUCTURE OF UNDER GRADUATE PROGRAM (BCA)

Sr. No.	Category	Break up of Credits BCA	BCA (Honours)	BCA (With Research)
1	Discipline-Specific Courses(DSC)-Major Course	76*	116*	104*
2	Minor(MIC)/Minor Vocational(MV)/MIC Vocational(VOC)/Skill Enhancement Courses (SEC)/Internship	37*	45*	45*
3	Multidisciplinary Courses	9*	9*	9*
4	Ability Enhancement Course	8*	8*	8*
5	Value Added Course	6*	6*	6*
6	Research Project/Dissertation	4*	4*	16*
	Total Credits	**140***	**188***	**188***

* Minor variations allowed as per need of the respective disciplines.

Students exiting the program after second semester and securing 48 credits including 4 credits of summer internship will be awarded UG Certificate in the relevant Discipline/Subject. Students exiting the program after fourth semester and securing 96 credits including 4 credits of summer internship will be awarded UG Diploma in the relevant Discipline/Subject. Students will be awarded 3-year UG Degree in relevant major Discipline/Subject upon securing 140 credits.

Four credits of internship earned by a student during summer internship after 2nd semester or 4th semester will be counted in 5th semester of a student who pursue 3 year UG Programs without taking exit option.

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Discipline-Specific Courses-Major Course	DSC
2	Minor Vocational	MV
3	MIC Vocational(VOC)	MICV
4	Skill Enhancement Courses	SEC
5	Multidisciplinary Courses	MDC
6	Ability Enhancement Courses	AEC
7	Value Added Courses	VAC
8	Internship	INT
9	Research Project	RP
10	Dissertation	DISS

Revised Scheme of Studies and Examination

BCA – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration In Hours
				L	T	P			Assessment	End Semester Exam	Practical	Total	
1	Discipline-Specific Courses Major Courses	DSC-BCA-301A	Software Engineering	4	0	0	4	4	30	70	-	100	3
2	Discipline-Specific Courses Major Courses	DSC-BCA-303A	Artificial Intelligence	4	0	0	4	4	30	70	-	100	3
3	Discipline-Specific Courses Major Courses	DSC-BCA-305A	Cloud Computing	3	0	0	3	3	25	50	-	75	3
		LC-BCA-307A	Cloud Computing Lab	0	0	2	1	1	10	-	15	25	3
4	Discipline-Specific Courses Major Courses	DSC-BCA-309A	Object Oriented Analysis and Design using UML	2	0	0	2	2	15	35	-	50	3
		LC-BCA-311A	Object Oriented Analysis and Design using UML Lab	0	0	4	2	2	15	-	35	50	3
5	Major Discipline Relevant Course (Vocational)-Minor Courses	Refer Table XII	----------	3	1	0	4	4	30	70	-	100	3
6	Internship	INT-BCA-317A	----------	0	0	0	0	4	30	-	70	100	
Total Credits								**24**	**185**	**295**	**120**	**600**	

Note:

1. Four credits of internship earned by a student during summer internship after the 2nd semester or 4th semester will be counted in the 5th semester of a student who pursues a 3-year UG Program without taking exit option.
2. After completion of the internship, students need to prepare a comprehensive report highlighting their learning and takeaways during the internship period. The internship duration is 8 weeks during the summer vacation. The Internship Report prepared after completion shall be assessed in the 5th Semester as a compulsory course.

Revised Scheme of Studies and Examination
BCA – 6th Semester
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration In Hours
				L	T	P			Assessment	End Semester Exam	Practical	Total	
1	Discipline-Specific Courses Major Courses	DSC-BCA-302A	Internet of Things (IoT)	3	0	0	3	3	25	50	-	75	3
		LC-BCA-304A	Internet of Things (IoT) Lab	0	0	2	1	1	10	-	15	25	3
2	Discipline-Specific Courses Major Courses	DSC-BCA-306A	Information and System Security	3	0	0	3	3	25	50	-	75	3
		LC-BCA-308A	Information and System Security Lab	0	0	2	1	1	10	-	15	25	3
3	Discipline-Specific Courses Major Courses	DSC-BCA-310A	Data Warehousing & Mining	3	0	0	3	3	25	50	-	75	3
		LC-BCA-312A	Data Warehousing & Mining Lab	0	0	2	1	1	10	-	15	25	3
4	Discipline-Specific Courses Major Courses	DSC-BCA-314A	Relational Database Management System	2	0	0	2	2	15	35	-	50	3
		LC-BCA-316A	Relational Database Management System Lab	0	0	4	2	2	15	-	35	50	3
5	Major Discipline Relevant Course (Vocational)-Minor Courses	Refer Table XIII	----------	3	1	0	4	4	30	70	-	100	3
6	Project	RP-BCA-322A	Project/Dissertation	0	0	0	0	4	25	-	75	100	3
			Total Credits					**24**	**190**	**255**	**155**	**600**	

Note: The panel of examiners for assessment of the Project Reports/Dissertation/Research Project/Summer Internship Reports shall be recommended by the Department of Computer Science and Application.

Semester-V

Table No. XII Major Discipline Relevant (Vocational) -Minor Courses

S. No.	Category	Course Code	Course Name
1	Major Discipline Relevant Course (Vocational) - Minor	MICV-307A	Business Policy and Strategy
2		MICV-309A	Computer Networks and Internet
3		LC-MICV-311A	Computer Networks and Internet Lab

Semester-VI

Table No. XIII Major Discipline Relevant (Vocational) -Minor Courses

S. No.	Category	Course Code	Course Name
1	Major Discipline Relevant Course (Vocational) - Minor	MICV-308A	Entrepreneurship Development
2		MICV-310A	Web Development
3		LC-MICV-312A	Web Development Lab

Semester-V

Course Code	DSC-BCA-301A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Software Engineering				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • Understand software engineering principles, processes, and methodologies including traditional and agile models for effective development, requirement analysis, design, and testing of software systems. • Apply project management, quality assurance, risk management, and maintenance practices to ensure reliable software delivery, release management, and long-term product sustenance.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall fundamental software engineering concepts, process models, requirements, design, testing, quality, and project management principles.	Level-1 Remember
CO2	Understand and explain key concepts in software processes, requirements, design, testing, quality management, and maintenance.	Level-2 Understand
CO3	Apply software engineering processes, requirements analysis, design, testing, quality assurance, and project planning techniques to develop reliable software systems.	Level-3 Apply
CO4	Analyze software processes, requirements, design, testing, quality, and sustenance practices across development lifecycles to evaluate their effectiveness and suitability.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 2 marks each from all units and remaining 8 questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

The evolving role of software, changing nature of software, layered technology, a process framework,
Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.
Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.

UNIT II

Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.
Project planning: Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.

UNIT III

Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.
Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT IV

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.
Release Management: Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring.
Product sustenance: Maintenance, updates, End of life, migration strategies.

Text Books

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023 (AICTE Recommended Textbook)
2. Software Engineering, Ian Somerville, 9th edition, Pearson education.
3. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

Reference Books

1. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007
2. Software Engineering: Principles and Practice Hans van Vliet

Video Links

Topics	Links
Waterfall Model	https://nptel.ac.in/courses/106101061
Increment Model	https://nptel.ac.in/courses/106105182
Agile Model	https://nptel.ac.in/courses/106105150
Quality Management	https://nptel.ac.in/courses/106105218

Course Code	DSC-BCA-303A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Artificial Intelligence				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	4	0	0	**4**	
Course Objectives	The objectives of this course are • Understand AI foundations, intelligent agents, search techniques (uninformed, informed, adversarial, evolutionary), and problem-solving methods. • Apply logical reasoning, uncertainty handling, planning, and explore AI domains like ML, CV, robotics, NLP, expert systems, and ethical issues.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define and recall fundamental concepts of Artificial Intelligence including intelligent agents, search techniques, logical reasoning, planning, uncertainty, AI domains, expert systems, and ethical issues.	Level-1 Remember
CO2	Explain the principles of rational agents, search strategies, knowledge representation, inference, planning, uncertainty handling, AI domains, expert systems, and ethical issues in AI.	Level-2 Understand
CO3	Apply AI techniques such as search algorithms, logical inference, planning, constraint satisfaction, probabilistic reasoning, fuzzy sets, and machine learning to solve problems.	Level-3 Apply
CO4	Analyze AI problems using appropriate agents, search strategies, knowledge representation, inference, planning methods, and evaluate AI applications with ethical considerations.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 2 marks each from all units and remaining 8 questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Al: What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents.

Knowledge-Based Agents: Introduction to Knowledge-Based Agents, The Wumpus World as an Example World. Problem-solving: Problem-solving agents.

UNIT II

Advanced Search Techniques: Uninformed Search: DFS, BFS, Iterative Deepening Search.

Informed Search: Best First Search, A* search, AO* search.

Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems(CSPs), Backtracking search for CSP.
Evolutionary Search Techniques: Introduction to evolutionary algorithms, Genetic algorithms, Applications of evolutionary search in AI.

UNIT III

Logical Reasoning and Uncertainty Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting.
Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems.
Introduction to Planning: Blocks World problem, Strips.
Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning,
Introduction to Fuzzy set theory: Introduction to fuzzy logic, Crisp sets vs Fuzzy sets, Definition of fuzzy set ,Membership function, Types of membership functions ,Properties of fuzzy sets, Support, core, height of fuzzy set ,α-cut (alpha cut) concept.

UNIT IV

Domains in AI: Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks, and their Applications.
Expert Systems: The architecture and role of expert systems include two case studies.
Legal and Ethical Issues: Concerns related to AI.

Text Books:

1. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
2. Nilsson Nils J, Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3. Dan W Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI Learning 2010.
4. Rajiv Chopra, Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024.

Reference Books:

1. M.C. Trivedi, Introduction to AI and Machine Learning, Khanna Book Publishing Company, 2024.
2. Russell, S. and Norvig, P., “Artificial Intelligence - A Modern Approach”, 3rd edition, Prentice Hall
3. Van Hirtum, A. & Kolski, C. (2020). Constraint Satisfaction Problems: Algorithms and Applications. Springer
4. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024.

Video Links

Topics	Links
Introduction to Al	https://nptel.ac.in/courses/106102220
Knowledge-Based Agents	https://nptel.ac.in/courses/106105077
Advanced Search Techniques	https://nptel.ac.in/courses/106105079
Logical Reasoning and Uncertainty Logic	https://nptel.ac.in/courses/106106140
Introduction to Fuzzy set theory	https://nptel.ac.in/courses/111102130

Course Code	DSC-BCA-305A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Cloud Computing				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • Understand cloud fundamentals, architecture, characteristics, deployment/service models (SaaS/IaaS/PaaS), virtualization (hypervisors, types), and comparisons with cluster/grid computing. • Evaluate cloud vendors (AWS, Azure, Google App Engine), service management (SLAs, load balancing), security challenges, and applications like big data analytics.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Remember and define the fundamentals, characteristics, deployment and service models of cloud computing, virtualization concepts, major cloud vendors, and basic cloud service management and security principles.	Level-1 Remember
CO2	Explain cloud computing fundamentals, models, virtualization, vendors, service management, and security across its architecture, deployment, and service layers.	Level-2 Understand
CO3	Apply cloud computing architectures, service models, virtualization techniques, and vendor platforms to deploy secure, scalable solutions addressing SLAs and security challenges.	Level-3 Apply
CO4	Analyze cloud architectures, service models, virtualization techniques, vendor platforms, and security mechanisms across deployment scenarios.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Cloud Computing Fundamentals: Cloud Computing definition, Characteristics of Cloud Computing, Cloud Computing Benefits and Limitations, Cloud Architecture; Cloud computing vs. Cluster computing vs. Grid computing; Applications: Technologies and Process required when deploying Web services.

UNIT II

Cloud Computing Model and Services: Cloud Computing Deployment model, Cloud Computing service models.

Introduction to Cloud Services: SaaS, IaaS, PaaS; Storage As a Service, Communication As a Service; Cloud-based big data/real time analytics, Understanding SOA; Improving Performance through Load Balancing.

UNIT III

Virtualization: Virtualization Basics: Objectives, Benefits of Virtualization, Emulation, Virtualization for Enterprise, VMware, Server Virtualization, Data Storage Virtualization, hypervisors, types of hypervisors, distributed management of virtual infrastructures.

UNIT IV

Cloud vendors and Service Management & Security: Amazon cloud, AWS Overview, Installation of AWS, Google app engine, azure cloud, Sales force.

Service Management in Cloud Computing: Service Level Agreements (SLAs), Comparing Scaling Hardware: Traditional vs. Cloud, Security Concepts: Cloud security challenges

TEXT/REFERENCE BOOKS:

1. Cloud Computing: A Practical Approach by Anthony T. Velte Toby J. Velte, Robert Elsenpeter, the McGraw-Hill.
2. Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more. by Dr. Kris Jamsa.
3. Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'ReillyMedia Inc.
4. Cloud Computing Bible, Barrie Sosinsky, Wiley-India.
5. Cloud Computing: Principles and Paradigms, Editors: RajkumarBuyya, James Broberg, Andrzej M. Goscinski, and Wile.
6. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
7. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India.

Video Links

Topics	**Links**
Introduction to Al	https://nptel.ac.in/courses/106102220
Knowledge-Based Agents	https://nptel.ac.in/courses/106105077
Advanced Search Techniques	https://nptel.ac.in/courses/106105079
Logical Reasoning and Uncertainty Logic	https://nptel.ac.in/courses/106106140
Introduction to Fuzzy set theory	https://nptel.ac.in/courses/111102130

Course Code	LC-BCA-307A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Cloud Computing Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To understand cloud computing fundamentals, deployment models, and service models through hands-on experiments. • To perform practical implementation of cloud services, virtualization, and web service deployment using cloud platforms. • To analyze cloud architecture, load balancing, and virtualization techniques for efficient system design.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Apply** cloud computing concepts to use SaaS, PaaS, IaaS, virtualization, and deploy basic cloud services.	Level-3 Apply
CO2	**Analyze** cloud architecture, deployment models, service models, and virtualization techniques.	Level-4 Analyze
CO3	**Evaluate** different cloud platforms, load balancing methods, and cloud services for suitable applications.	Level-5 Evaluate
CO4	**Create** and deploy virtual machines, web services, and simple applications on cloud platforms.	Level-6 Create

Exp. No.	Experiments
1	Study different Cloud Computing characteristics (On-demand, scalability, elasticity) and prepare comparison table.
2	Compare Cloud vs Grid vs Cluster computing with examples.
3	Create a diagram showing Cloud Architecture (Front-end, Back-end, Internet, Services).
4	Study benefits and limitations of Cloud Computing and prepare case study.
5	Deploy a simple web service using any free cloud platform (AWS / Azure / Google Cloud / Replit).
6	Study Cloud Deployment Models (Public, Private, Hybrid, Community) with real examples.
7	Compare Service Models (IaaS, PaaS, SaaS) with practical examples.
8	Create account on SaaS application (Google Docs / Office 365) and demonstrate usage.
9	Demonstrate Storage as a Service using Google Drive / OneDrive.
10	Demonstrate Communication as a Service using Google Meet / Zoom.
11	Study Cloud-based Big Data analytics using Google Colab.
12	Implement Load Balancing concept using round-robin example.
13	Install VirtualBox / VMware and create virtual machine.
14	Install operating system in virtual machine.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	DSC-BCA-309A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Object Oriented Analysis and Design using UML				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	2	0	0	**2**	
Course Objectives	The objectives of this course are to • To understand the fundamentals of web development using the .NET framework, including its architecture, execution model, and development tools such as IIS, SQL Server, and Visual Studio. • To develop proficiency in object-oriented programming concepts such as classes, inheritance, polymorphism, interfaces, and exception handling using C#. • To design and implement Windows-based applications with user interfaces and database connectivity using ADO.NET for data access and manipulation.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the fundamental concepts of UML, object-oriented modeling, state and interaction modeling, and system analysis and design including principles, elements, relationships, diagrams, and architectural aspects.	Level-1 Remember
CO2	**Explain** the concepts of UML, object-oriented modeling, class and state modeling, interaction modeling, and system analysis and design including principles, relationships, diagrams, and architectural considerations.	Level-2 Understand
CO3	**Apply** UML techniques, object-oriented modeling concepts, state and interaction models, and system analysis and design methods to develop models, diagrams, and solutions for real-world systems.	Level-3 Apply
CO4	**Analyze** UML models, object-oriented designs, state and interaction behaviors, and system architectures to evaluate system requirements, subsystem organization, concurrency, and design strategies.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 marks each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

UML: Principles of modeling, UML Things – Structural, Behavioral, Grouping, Annotational. Relationships in UML – Dependency, Association, Generalization, Realization. Overview of diagrams in UML – Class diagram, Object diagram, Use-Case diagram, Sequence diagram, Collaboration diagram, State chart diagram, Activity diagram, Component diagram, Deployment diagram. UML Semantic Rules – Names, Scope, Visibility, Integrity, Execution. Mechanisms in the UML – Specifications, Adornments, Common Divisions, Extensibility Mechanisms.

UNIT – II

Modeling as a Design Technique: Abstraction, Encapsulation, Modularity, Hierarchy, Typing, Concurrency, Persistence of objects. Purpose of modeling, Class Model – Object & Class, Links & Associations, Generalization & Inheritance, Association Ends - Multiplicity, Role names, Ordering, Qualification, Aggregation, Link attributes & Link class, Abstract class, Metadata, Constraints.

UNIT – III

State Modeling: Event, State, Activity, Action, Transitions & Conditions, State diagrams, Nested state diagrams, signal generalization, concurrency, relationships between class and state models.

Interaction Modeling: use case models, use case relationships, sequence models, procedural sequence models, activity models, special constructs for activity models.

UNIT – IV

System Analysis & design: System development stages, system conception, analysis, domain class model, domain state model, iterating the analysis. class model, application.

System Design: estimating performance, make a reuse plan, organize the system into subsystem, identifying concurrency, allocating subsystems to processors and tasks, management of data stores, handling global resources, choosing software control strategies, handling boundary conditions, setting trade-off priorities, selecting an architect style.

Suggested Readings:

1. Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Pearson Education.
2. M. Blaha, J. Rumbaugh, Object-Oriented Modeling and Design with UML, Pearson Education.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Pearson education.
4. Satzinger, Jackson, Burd, Object-Oriented Analysis & Design with the Unified Process, Thomson.
5. Grady Booch, Object Oriented Analysis & Design, Addison Wesley.
6. Timothy C. Lethbridge, Robert Laganiere, Object Oriented Software Engineering,

Useful Video links:

Topics	Links
Introduction to UML	https://nptel.ac.in/courses/106105224
Modeling as a Design Technique	https://youtu.be/c6mLMnXT54E?si=jMxaHT-aGcRBSH9E
State Modeling	https://youtu.be/_f6z7YfgszQ?si=wi4JAjMhRVIzVsn9
System Analysis & design	https://nptel.ac.in/courses/106108102

Course Code	LC-BCA-311A				
Category	Discipline- Specific Courses-Major Courses				
Course Title	Object Oriented Analysis and Design using UML Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts of UML and apply different UML diagrams for modeling software systems. • To develop class, state, and interaction models using object-oriented design concepts such as abstraction, inheritance, association, and aggregation. • To perform system analysis and design by creating domain models, identifying subsystems, and applying UML techniques for real-world applications.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Apply** UML techniques to develop class, use case, sequence, activity, state, component, and deployment diagrams.	Level-3 Apply
CO2	**Analyze** system requirements by identifying objects, relationships, states, interactions, and subsystems using UML models.	Level-4 Analyze
CO3	**Evaluate** UML design models and architectural styles for suitable software solutions.	Level-5 Evaluate
CO4	**Create** complete system analysis and design models using domain class, interaction, state, and subsystem diagrams.	Level-6 Create

Exp. No.	Experiments
1	Study different UML Things: Structural, Behavioral, Grouping, Annotational with examples.
2	Draw UML Relationships (Dependency, Association, Generalization, Realization).
3	Draw Class Diagram for Library Management System.
4	Draw Object Diagram for Student Information System.
5	Draw Use Case Diagram for Online Shopping System.
6	Draw Sequence Diagram for ATM Withdrawal.
7	Draw Collaboration Diagram for Online Banking System.
8	Draw State Chart Diagram for Order Processing System.

9	Draw Activity Diagram for Student Admission Process.
10	Draw Component Diagram and Deployment Diagram for Web Application.
11	Create Class Model showing Object, Class and Associations.
12	Draw diagram showing Generalization and Inheritance.
13	Draw Aggregation and Composition example.
14	Implement Multiplicity, Role names and Association Ends in class diagram.
15	Create diagram using Abstract Class and Constraints.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	MICV- 307A				
Category	Major Discipline Relevant Course (Vocational) – Minor				
Course Title	Business Policy and Strategy				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are to • To understand the foundational concepts, processes, and significance of business policy and strategic management. • To understand various strategy types and their application at the corporate, business, and functional levels. • To understand the implementation aspects of strategy, including structural, behavioral, and functional dimensions. • To understand techniques for evaluating and controlling strategies, including McKinsey's 7S Framework.				
Assessment	30 Marks				
End Semester Examination	70Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the framework of business policy and strategic management, including strategic intent, environmental and organizational appraisal, types of strategies, implementation methods, evaluation, and control techniques.	Level-1 Remember
CO2	**Explain** the framework of strategic management, including strategic intent, environmental and organizational appraisal, strategy types, implementation, and control.	Level-2 Understand
CO3	**Apply** strategic tools and models such as SWOT, PEST, Porter's Five Forces, BCG Matrix, GE 9-cell Matrix, McKinsey's 7s Framework to formulate strategies, implement them through resource and structural planning, and evaluate their effectiveness using control techniques.	Level-3 Apply
CO4	**Analyze** the internal and external environment, strategic alternatives at corporate, business, and functional levels, as well as implementation challenges related to structure, culture, leadership, and ethics, and apply strategic control systems.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

UNIT – I

Introduction to Business Policy and Strategic Management:- Definition, Concept, Objective and Significance, The levels at which strategy operates, Strategic Management Process, strategic intent: Vision, Mission, Business definition, Goals, and Objectives.

Environment Appraisal:- Concept and Environmental Sector; PEST Analysis, Organizational Appraisal: Concepts and Capability Factors; Porter's Value Chain Model, SWOT Analysis as a Tool for assessing Organizational Capabilities and Environment Opportunities.

UNIT – II

Type of Strategies:- Corporate Level (Concept of Grand Strategies), Business Level, and Functional Level, Guidelines for Crafting Successful Business Strategies. Strategy Analysis and Choice: Corporate Level Strategy Analysis: BCG Matrix and GE 9 cell Matrix, Business Level Strategy Analysis: Life Cycle Analysis, Porter's Five Forces of Industry Analysis, Strategic Choice, and Process of Strategic Choice.

UNIT – III

Strategy Implementation:- Interrelation Between Strategy Formulation and Implementation, Aspects of Strategy Implementation, An overview of Project, Procedural Implementation, Resource Allocation, Structural Implementation. Behavioural Implementation: An overview of: Leadership, Corporate Culture, Corporate Politics and Use of Power, Personal Values and Business Ethics, Functional /Operational Implementation.

UNIT – IV

Strategy Evaluation and Control:- An Overview of Strategic Evaluation and Control, Techniques for Strategic Evaluation and Control, Role of Organizational Systems in Evaluation, McKinsey's 7s Framework.

Suggested Readings:

- Business Policy and Strategic Management by Azhar Kazmi, Tata McGraw-Hill, New Delhi.
- Strategic Management and Business Policy by Wheelen and Hunger, Pearson Education.
- Strategic Management by Chandrasekharan, Oxford University Press.
- Crafting and Executing Strategy: The Quest for Competitive Advantage by A. Thompson Jr., A. J. Strickland III, and J. E. Gamble, Tata McGraw-Hill.
- Strategic Management: Concepts and Cases by Fred R. David, Pearson Education.
- Strategic Management: Competitiveness and Globalization by M. A. Hitt, R. D. Ireland, and R. E. Hoskisson, Thomson Asia Pvt. Ltd.
- Strategic Management: Strategy Formulation and Implementation by J. A. Pearce II and R. B. Robinson Jr., AITBS Publishers and Distributors, Delhi.
- Management Policy and Strategic Management: Concepts, Skills and Practices by R. M. Srivastava, Himalayan Publishing House.
- Managing in a Time of Great Change by Peter F. Drucker, Truman Talley Books / Plume, Penguin Group.

Useful Video links:

Topics	Links
Strategic Management Process	https://nptel.ac.in/courses/110108047
Environment Appraisal	https://nptel.ac.in/courses/110107509
Corporate Level and Business Level Strategies	https://nptel.ac.in/courses/110105161
Strategy Implementation	https://nptel.ac.in/courses/122105024
Case Study	https://nptel.ac.in/courses/122105024
McKinsey's 7s Framework	https://nptel.ac.in/courses/110108161

Course Code	MICV-309A				
Category	Major Discipline Relevant Course (Vocational) - Minor				
Course Title	Computer Networks and Internet				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To understand the fundamental concepts of computer networks, data communication components, network models (OSI & TCP/IP), and transmission media. • To explain and analyze the functions of Data Link, Network, Transport, and Application layers, including framing, error and flow control, MAC protocols, IP addressing, routing techniques, and protocols such as TCP, UDP, DNS, HTTP, FTP, and SMTP. • To explore and evaluate the structure of the Internet and World Wide Web, along with network security concepts, cryptographic techniques, and emerging technologies such as wireless networks, IoT, and cloud computing.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of computer networks, models, and transmission media.	Level-1 Remember
CO2	Explain networking layers, protocols, and communication techniques.	Level-2 Understand
CO3	Apply networking concepts to analyze routing, error control, and internet services.	Level-3 Apply
CO4	Analyze network security issues and evaluate modern networking technologies.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Computer Networks: Definition and importance of computer networks, Data communication concepts, Components, data flow, transmission modes, Types of networks(LAN, MAN, WAN, PAN),Network topologies, Bus, Star, Ring, Mesh, Hybrid ,OSI Reference Model, Layers, functions, and services ,TCP/IP Model, Architecture and comparison with OSI model, Transmission media, Guided (Twisted Pair, Coaxial, Optical Fiber) and Unguided (Radio waves, Microwave, Satellite)

UNIT – II

Data Link and Network Layer: Data Link Layer Functions and services, Framing techniques: Character count, byte stuffing, bit stuffing**,** Error detection and correction: Parity, CRC, Hamming Code**,** Flow

control protocols: Stop-and-Wait, Sliding Window**,** Medium Access Control: ALOHA, CSMA/CD, CSMA/CA

Network Layer: Logical addressing: IPv4 and IPv6**,**Subnetting and Supernetting**,** Routing algorithms: Distance Vector, Link State **,**Routing protocols, RIP, OSPF, BGP **,**Congestion control techniques

UNIT – III

Transport Layer: Functions and services, Connection-oriented vs Connectionless service, TCP vs UDP (features and comparison) ,Flow control and congestion control in TCP

Application Layer: Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP/HTTPS),File Transfer Protocol (FTP) ,Simple Mail Transfer Protocol (SMTP),Telnet and SSH

UNIT – IV

Internet fundamentals: Structure, ISP, Internet services, World Wide Web (WWW): Working and architecture ,Web browsers and search engines

Network security concepts: Threats, attacks, vulnerabilities Cryptography basics (Symmetric & Asymmetric encryption) ,Firewalls and Intrusion Detection Systems

Emerging trends: Wireless networks (Wi-Fi, Bluetooth) ,Mobile communication (3G, 4G, 5G basics) ,Internet of Things (IoT) ,Cloud computing basics

Reference Books

1. **Behrouz A. Forouzan**, Data Communications and Networking, 5th ed., McGraw-Hill Education, 2013.
2. **Andrew S. Tanenbaum** and David J. Wetherall, Computer Networks, 5th ed., Pearson Education, 2010.
3. **James F. Kurose** and Keith W. Ross, Computer Networking: A Top-Down Approach, 8th ed., Pearson Education, 2021.
4. **William Stallings**, Data and Computer Communications, 10th ed., Pearson Education, 2013.
5. **Nader F. Mir**, Computer and Communication Networks, 2nd ed., Pearson Education, 2014.
6. **Douglas E. Comer**, Internetworking with TCP/IP, Vol. 1, 6th ed., Pearson Education, 2014.

Video Links

Topics	**Links**
Network basics, OSI model ,TCP/IP model ,Topologies	https://nptel.ac.in/courses/106106091
Framing, Error detection (CRC, Hamming) ,Flow control ,MAC protocols (ALOHA, CSMA/CD) ,Routing algorithms, IP addressing	https://nptel.ac.in/courses/106105081
TCP vs UDP ,Congestion control ,DNS, HTTP, FTP, SMTP, Application layer protocols	https://nptel.ac.in/courses/106105183
Internet Technology	https://nptel.ac.in/courses/106105084
Cryptography and Network Security	https://nptel.ac.in/courses/106105031
Wireless Communication	https://nptel.ac.in/courses/108102096
Cloud Computing	https://nptel.ac.in/courses/106105167

Course Code	LC-MICV-311A				
Category	Major Discipline Relevant Course (Vocational) - Minor				
Course Title	Computer Networks and Internet Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To apply fundamental networking concepts to design and simulate network topologies, IP addressing, and communication. • To analyze data communication techniques such as framing, error detection, and flow control protocols. • To evaluate and create network applications using client-server programming, protocol analysis, and basic network security configurations.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Apply** networking concepts to implement topologies, IP addressing, and simulations.	Level-3 Apply
CO2	**Analyze** framing, error detection, and flow control techniques.	Level-4 Analyze
CO3	**Evaluate** transport and application layer protocols using programming and tools.	Level-5 Evaluate
CO4	**Create** network solutions using socket programming, routing, and security configurations.	Level-6 Create

EXP. No.	Experiments
1	Study different types of networks (LAN, MAN, WAN, PAN) with real-life examples.
2	Implement basic network topologies (Bus, Star, Ring) using Cisco Packet Tracer.
3	Create and analyze Star topology and test communication between nodes.
4	Compare different transmission media (Twisted Pair, Coaxial, Optical Fiber) using charts or simulation.
5	Study OSI Model layers and map real-world protocols to each layer.
6	Implement framing techniques (Character count / Byte stuffing) using C program.
7	Write a program for error detection techniques using Parity Bit and CRC.
8	Implement Hamming Code for error detection and correction.
9	Simulate flow control protocols: Stop-and-Wait and Sliding Window.
10	Perform IP addressing and subnetting calculations manually.
11	Configure IPv4 addressing and test connectivity using ping command.
12	Study and simulate routing algorithms (Distance Vector, Link State).

13	Compare TCP and UDP using a simple client-server program.
14	Create a basic client-server communication using sockets in C/Python.
15	Study Application layer and security concepts: • DNS lookup using nslookup • HTTP working using browser developer tools • WWW request-response cycle • Basic firewall / packet filtering (simulation)

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	INT-BCA-317A				
Category	Internship				
Course Title	Industry Internship				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	0	**4**	
Course Objectives	The objectives of this course are to • Develop project planning and management skills for successful technical execution. • Enhance software development, database design, and system integration capabilities. • Apply structured problem-solving methods to resolve complex technical issues. • Improve professional communication skills, both written and verbal. • Understand and apply ethical principles in software engineering practices				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify emerging technologies and interdisciplinary fields for hands-on industrial training.	Level-1 Remember
CO2	Describe report writing and presentation skills in technical and industrial contexts.	Level-2 Understand
CO3	Apply engineering principles to analyze and solve real-world industrial problems.	Level-3 Apply
CO4	Assess ethical standards and tools across diverse technological domains.	Level-4 Analyze
CO5	Evaluate personal performance in communication, teamwork, and technical proficiency.	Level 5: Evaluate
CO6	Design and develop industry-relevant software or hardware systems.	Level 6: Create

Overview:

Internship is a foundational course that introduces students to the research process in computer science and information technology. This course provides students with the necessary skills and knowledge to undertake independent research projects. Students will learn to identify research problems, conduct literature reviews, design research methodologies, collect and analyze data, and present their findings effectively.

The candidates will submit the internship report in the prescribed format designed by the department. The report will be evaluated by an examiner appointed by the Controller of Examination (or a committee constituted by the Director of the Institute) from the approved panel of examiners.

Assessment Framework

Sr. No.	Exam Type	Stage No.	Criteria	Assessment	Marks	Overall Weightage
1	Internal	Stage-I	Assessment by Mentor	Rubric I	30	30%
2.	External / End Semester Exam	Stage-II	Internship Report	Rubric II	40	70%
		Stage-II	Viva-Voce	Rubric III	30	
Total					100	100%

1. Internal Assessment (30 Marks – 30%)

The internal evaluation is carried to monitor student performance, project development and continuous improvement.

Rubric I: Assessment by Mentor					
Parameters/Assessment Levels	**Excellent**	**Good**	**Average**	**Poor**	**Marks**
Skills Learned (15 Marks)	15-13: Acquired and effectively applied technical/professional skills independently.	12-10: Good acquisition and application of skills.	09-06: Basic skills acquired with guidance.	05-00: Limited skill development.	
Regularity & Attendance (10 Marks)	10-09: Highly regular, punctual, and committed.	08-07: Generally regular with minor deviations.	06-04: Moderate attendance and punctuality.	03-00: Irregular participation.	
Professional Conduct (05 Marks)	05: Excellent discipline, teamwork, ethics, and communication.	04: Good professional behavior.	03-02: Satisfactory conduct.	03-02: Satisfactory conduct.	
Total Marks					30

2. External Assessment (70 Marks – 70%)

Rubric II: Internship Report (40 Marks)						
Sr. No.	**Parameters/Assessment Levels**	**Excellent**	**Good**	**Average**	**Poor**	**Marks**
1	Organization Profile & Internship Objectives (08 Marks)	08-07: Clearly describes organization, objectives, and scope of work.	06-05: Adequate description.	04-03: Limited details.	02-00: Poor description.	
2	Work Performed & Technical Understanding (10 Marks	10-09: Excellent understanding and documentation of assigned work.	08-07: Good understanding.	06-04: Basic understanding.	03-00: Limited understanding.	
3	Learning Outcomes & Skill Development (08 Marks)	08-07: Significant learning and skill enhancement demonstrated.	06-05: Good learning outcomes.	04-03: Moderate learning.	02-00: Limited learning.	
4	Problem Solving & Contribution (08 Marks)	08-07: Demonstrates strong analytical and problem-solving ability.	06-05: Good contribution.	04-03: Limited contribution.	02-00: Minimal contribution.	
5	Report Quality & Presentation (06 Marks)	06: Well-structured, professional, and error-free report.	05-04: Good report quality.	03-02: Average presentation.	01-00: Poor report organization.	
Total Marks						40

Rubric III: Viva-Voce (30 Marks)						
Sr. No.	**Parameters / Assessment Levels**	**Excellent**	**Good**	**Average**	**Poor**	**Marks**
1	Understanding of Internship Work (08 Marks)	08-07: Demonstrates excellent understanding of work and processes.	06-05: Good understanding.	04-03: Basic understanding.	02-00: Poor understanding.	
2	Technical Knowledge & Application (08 Marks)	08-07: Strong technical knowledge with practical application.	06-05: Good technical knowledge.	04-03: Moderate knowledge.	02-00: Limited knowledge.	
3	Problem Solving & Learning Experience (06 Marks)	06-05: Clearly explains challenges faced and solutions adopted.	04: Good explanation.	03-02: Basic explanation.	01-00: Unable to explain.	
4	Communication & Professionalism (08 Marks)	08-07: Communicates confidently and professionally.	06-05: Good communication.	04-03: Average communication.	02-00: Poor communication skills..	
Total Marks						30

Semester-VI

Course Code	DSC-BCA-302A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Internet of Things(IoT)				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of Internet of Things (IoT) architecture, communication models, networking protocols, and enabling technologies. • To develop understanding of IoT hardware platforms, sensor interfacing, embedded systems, and cloud-based IoT applications. • To analyze IoT applications, security challenges, and modern IoT solutions for real-world problem solving.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the concepts of IoT architecture, communication protocols, IoT hardware platforms, and IoT applications & security mechanisms.	Level-1 Remember
CO2	Explain IoT networking models, sensor interfacing techniques, cloud platforms, and security challenges in IoT systems.	Level-2 Understand
CO3	Apply IoT protocols, embedded platforms, programming techniques, and cloud services for developing IoT-based applications.	Level-3 Apply
CO4	Analyze IoT architectures, communication technologies, hardware platforms, and security issues for real-world IoT solutions.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Internet of Things:- Characteristics and Features of IoT, Evolution and Scope of IoT, Applications of IoT in various domains, Components of IoT System, IoT Architecture, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Communication Models, IoT Communication APIs, Challenges and Issues in IoT.

UNIT II

IoT Communication and Networking: Sensors and Actuators, Basics of Embedded Systems, RFID Technology, Wireless Sensor Networks (WSN), Networking Concepts in IoT, IPv4 and IPv6, MQTT Protocol, CoAP Protocol, ZigBee Technology, Bluetooth and Bluetooth Low Energy (BLE), Wi-Fi for IoT, Data Communication in IoT, Cloud Connectivity in IoT, Machine-to-Machine (M2M) Communication.

UNIT III

IoT Hardware and Software Platforms: Introduction to Arduino Platform, Raspberry Pi Platform, NodeMCU and ESP8266, Interfacing Sensors with Arduino, IoT Programming Basics, Python Programming for IoT, Embedded C Basics, Data Acquisition Techniques, IoT Middleware, Cloud Platforms for IoT, ThingSpeak Application, Blynk Application, Data Storage and Processing in IoT.

UNIT IV

IoT Applications and Security:-Smart Home Systems, Smart City Applications, Smart Agriculture, Healthcare Applications of IoT, Industrial Internet of Things (IIoT), Wearable Devices, IoT Data Analytics, Security Challenges in IoT, Privacy Issues in IoT, IoT Security Techniques, Future Trends in IoT, Case Studies of IoT Applications.

Text Books

1. **Internet of Things: A Hands-On Approach**, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
2. **Internet of Things**, Samuel Greengard, MIT Press, 2015.
3. **Learning Internet of Things**, Peter Waher, Packt Publishing, 2015.
4. **Fundamentals of Internet of Things**, Sudip Misra, Anandarup Mukherjee and Arijit Roy, Cambridge University Press, 2019.

Reference Books

1. **Internet of Things: Principles and Paradigms**, Rajkumar Buyya and Amir Vahid Dastjerdi, Morgan Kaufmann, 2016.
2. **Designing the Internet of Things**, Adrian McEwen and Hakim Cassimally, Wiley Publications, 2014.
3. **Building the Internet of Things**, Maciej Kranz, Wiley Publications, 2016.

Video Links

Topics	Links
Introduction to Internet of Things	https://nptel.ac.in/courses/106104242
Sensors and Actuators	https://nptel.ac.in/courses/108108123
Arduino Platform	https://youtu.be/CFL3E0or2HU?si=LLcq9fQkt0tnglo2
IoT Applications	https://nptel.ac.in/courses/108108123

Course Code	LC-BCA-304A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Internet of Things(IoT) Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To provide practical knowledge of IoT architecture, communication protocols, sensors, actuators, and embedded platforms used in IoT systems. • To develop skills for analyzing IoT communication, cloud connectivity, real-time data acquisition, and security challenges in IoT applications. • To design and implement IoT-based real-world applications using modern hardware, software, and cloud technologies.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply IoT architecture, communication models, sensors, actuators, and embedded platforms for basic IoT applications.	Level-3 Apply
CO2	Analyze IoT device interfacing, wireless communication, cloud connectivity, and real-time sensor data in IoT systems.	Level-4 Analyze
CO3	Evaluate IoT network performance, security challenges, and authentication mechanisms for secure IoT communication.	Level-5 Evaluate
CO4	Design IoT-based real-world solutions using appropriate hardware, software, cloud platforms, and communication technologies.	Level-6 Create

Exp. No.	Experiments
1	Study IoT architecture, components, and communication models.
2	Examine IoT sensors, actuators, and embedded system platforms.
3	Demonstrate LED and push button interfacing using Arduino board.
4	Implement temperature and humidity sensor interfacing with Arduino.
5	Implement ultrasonic sensor for distance measurement application.
6	Demonstrate RFID based identification and tracking system.
7	Implement serial communication between Arduino and computer system.
8	Configure NodeMCU/ESP8266 for Wi-Fi based IoT connectivity.
9	Develop a simple IoT application using Raspberry Pi platform.
10	Implement MQTT protocol for IoT device communication.
11	Implement Bluetooth/BLE based wireless communication system.
12	Develop cloud-based sensor monitoring using ThingSpeak platform.
13	Analyze real-time sensor data acquired from multiple IoT devices.
14	Analyze communication performance and connectivity issues in IoT networks.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	DSC-BCA-306A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Information and System Security				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of information security principles, cryptographic techniques, system security, and network security mechanisms. • To develop understanding of authentication methods, access control techniques, web security vulnerabilities, and cyber security threats in modern information systems. • To analyze and implement security solutions for protecting information systems, networks, databases, and web applications against cyber attacks and vulnerabilities.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of information security, cryptography, system security, access control, web security, and cyber security threats.	Level-1 Remember
CO2	Explain encryption techniques, authentication methods, security mechanisms, malware protection, and web security vulnerabilities in information systems.	Level-2 Understand
CO3	Apply cryptographic algorithms, firewall and IDS techniques, authentication mechanisms, and security tools for securing information systems and networks.	Level-3 Apply
CO4	Analyze security attacks, system vulnerabilities, cyber threats, web application risks, and emerging trends in information and system security.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Information and System Security: Introduction to Information Security, Need and Goals of Security, Security Attacks and Threats, Security Services and Mechanisms, Principles of Information Security, Confidentiality, Integrity and Availability (CIA Triad), Authentication and Authorization, Security Policies and Models, Risk Management and Risk Analysis, Cyber Security Fundamentals, Types of Cyber Crimes, Ethical Hacking Concepts, Vulnerabilities and Threat Assessment.

UNIT II

Cryptography and Network Security: Introduction to Cryptography, Plain Text and Cipher Text, Encryption and Decryption Techniques, Classical Encryption Techniques, Symmetric Key Cryptography, Asymmetric Key Cryptography, Public Key Infrastructure (PKI), Data Encryption Standard (DES), Advanced Encryption Standard (AES), RSA Algorithm, Hash Functions, Digital Signatures, Key Management, Network Security Concepts, Firewalls, Virtual Private Networks (VPN), Intrusion Detection System (IDS), Intrusion Prevention System (IPS), Secure Socket Layer (SSL) and Transport Layer Security (TLS).

UNIT III

System Security and Access Control: Operating System Security, Database Security, File System Security, Access Control Mechanisms, Authentication Techniques, Password Management, Biometrics, Malware and Malicious Software, Viruses, Worms, Trojans, Spyware and Ransomware, System Vulnerability Assessment, Security Auditing, Security Monitoring, Backup and Recovery Mechanisms, Security in Distributed Systems, Cloud Security Fundamentals, Mobile and Wireless Security Issues.

UNIT IV

Web Security and Emerging Trends: Web Security Concepts, Web Application Vulnerabilities, SQL Injection, Cross Site Scripting (XSS), Session Hijacking, Phishing and Social Engineering Attacks, E-mail Security, Secure Electronic Transactions, Digital Certificates, Cyber Forensics, Incident Response and Disaster Recovery, Security Standards and Policies, Legal and Ethical Issues in Information Security, IoT Security, Blockchain Security Basics, Emerging Trends in Cyber and Information Security.

Text Books

1. Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, Cengage Learning, 2022.
2. Cryptography and Network Security, William Stallings, Pearson Education, 2023.
3. Fundamentals of Information Systems Security, David Kim and Michael G. Solomon, Jones & Bartlett Learning, 2021.
4. Computer Security: Principles and Practice, William Stallings and Lawrie Brown, Pearson Education, 2018.

Reference Books

1. Managing Information System Security, Gurpreet Dhillon, Palgrave Macmillan, 1997.
2. Security of Computer Based Information Systems, V. P. Lane, Palgrave Macmillan, 1985.
3. Network Security Essentials: Applications and Standards, William Stallings, Pearson Education, 2017.
4. Information Security Handbook, John M. D. Hunter, Springer, 2001.
5. Cyber Security Essentials, James Graham, Richard Howard and Ryan Olson, CRC Press, 2016.

Video Links

Topics	Links
Types of Cyber Crimes	https://www.youtube.com/watch?v=HWr4-mWWvjw
Cryptography	https://www.youtube.com/watch?v=iTVyKbDCJrA&list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2
Operating System Security	https://www.youtube.com/watch?v=LBSttNg-q84&list=PLyqSpQzTE6M-at1naX10LV_n5WqRgYlBU&index=2
Cross Site Scripting (XSS)	https://www.youtube.com/watch?v=6fuKefq9KBo

Course Code	LC-BCA-308A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Information and System Security Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop practical knowledge of cryptographic techniques, authentication methods, firewall configuration, and network security mechanisms for protecting information systems. • To analyze system vulnerabilities, malware attacks, web security threats, and cyber security issues using modern security tools and techniques. • To design and implement secure information systems and web applications using appropriate security protocols, access control methods, and cyber security practices.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply cryptographic techniques, authentication methods, firewall configurations, and security tools for securing information systems and networks.	Level-3 Apply
CO2	Analyze system vulnerabilities, malware behavior, web security threats, and network security issues in information systems.	Level-4 Analyze
CO3	Evaluate security mechanisms, access control techniques, cyber security policies, and protection methods for secure computing environments.	Level-5 Evaluate
CO4	Design and develop secure information systems and web security applications using appropriate security tools, protocols, and security techniques.	Level-6 Create

Exp. No.	Experiment
1	Study of information security principles, security attacks, and security services.
2	Demonstrate implementation of classical encryption and decryption techniques.
3	Implement Caesar Cipher and Playfair Cipher algorithms.
4	Implement DES and AES encryption algorithms for secure communication.
5	Implement RSA algorithm for public key cryptography.
6	Demonstrate generation and verification of digital signatures.
7	Configure user authentication and password management techniques in operating systems.
8	Implement access control mechanisms for system security.
9	Configure and analyze firewall rules for network protection.
10	Demonstrate Intrusion Detection System (IDS) and Intrusion Prevention System (IPS).
11	Perform vulnerability assessment using security analysis tools.

12	Implement backup and recovery mechanisms for system security.
13	Demonstrate secure communication using SSL/TLS protocols.
14	Analyze malware behavior and system vulnerabilities in information systems.
15	Analyze web application security threats such as SQL Injection and Cross Site Scripting (XSS).

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	DSC-BCA-310A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Data Warehousing & Mining				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of data warehousing architecture, OLAP operations, data preprocessing techniques, and data mining concepts. • To develop understanding of association rule mining, classification, clustering techniques, and data analysis using modern data mining tools. • To analyze and apply data warehousing and data mining techniques for knowledge discovery and decision-making in real-world applications.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of data warehousing, data preprocessing, association rule mining, classification, clustering, and data mining tools.	Level-1 Remember
CO2	Explain data warehouse architecture, OLAP operations, preprocessing techniques, classification methods, clustering techniques, and WEKA tool functionalities.	Level-2 Understand
CO3	Apply data preprocessing methods, association rule mining algorithms, classification techniques, clustering methods, and WEKA tool for data analysis.	Level-3 Apply
CO4	Analyze data warehouse models, frequent pattern mining techniques, classification performance, clustering results, and real-world data mining applications.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Data Warehousing and Data Mining: Introduction to Data Warehousing, Need and Applications of Data Warehousing, Characteristics of Data Warehouse, Data Warehouse Architecture, Data Warehouse Models, Data Mart, Metadata, OLTP and OLAP Systems, Difference between OLTP and OLAP, Data Warehouse Schema Design – Star Schema, Snowflake Schema and Fact Constellation Schema, Introduction to Data Mining, Knowledge Discovery in Databases (KDD) Process, Data Mining Functionalities, Data Mining System Classification, Issues and Applications of Data Mining.

UNIT II

Data Preprocessing and Data Warehouse Operations: Data Objects and Attribute Types, Statistical Description of Data, Data Cleaning, Data Integration, Data Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation, Data Visualization Techniques, Similarity and Dissimilarity Measures, OLAP Operations – Roll-up, Drill-down, Slice, Dice and Pivot, Data Cube Technology, Data Warehouse Implementation and Maintenance.

UNIT III

Association Rule Mining and Classification: Mining Frequent Patterns, Association and Correlation Analysis, Apriori Algorithm, Frequent Pattern Growth Method, Constraint Based Association Mining, Multilevel and Multidimensional Association Rules, Classification and Prediction, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Support Vector Machines, Classification using Back Propagation, Lazy Learners, Model Evaluation and Accuracy Improvement Techniques.

UNIT IV

Clustering, Web Mining and Data Mining Tools: Cluster Analysis, Partitioning Methods, Hierarchical Clustering Methods, Density Based Clustering Methods, Grid Based Clustering Methods, Constraint Based Clustering, Clustering High Dimensional Data, Outlier Analysis and Outlier Detection Methods, Introduction to Web Mining, Web Content Mining, Web Structure Mining, Web Usage Mining, Introduction to WEKA Tool, WEKA Interface and Datasets, Data Mining using WEKA Tool, Applications of Data Warehousing and Data Mining.

Text Books

1. Data Warehousing Fundamentals, Paulraj Ponniah, Wiley India, 2011.
2. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012.
3. Data Warehousing in the Real World, Sam Anahory and Dennis Murray, Pearson Education, 2008.
4. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education, 2019.

Reference Books

1. Data Mining Techniques, Arun K. Pujari, Universities Press, 2013.
2. Data Warehouse Toolkit, Ralph Kimball and Margy Ross, Wiley India, 2013.
3. Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, Eibe Frank and Mark A. Hall, Morgan Kaufmann, 2016.
4. Fundamentals of Data Warehouses, Matthias Jarke, Morgan Kaufmann Publishers, 2003.
5. Building the Data Warehouse, W. H. Inmon, Wiley India, 2005.

Video Links

Topics	Links
Knowledge Discovery in Databases	https://nptel.ac.in/courses/106105174
Association Rule Mining	https://nptel.ac.in/courses/106106853
Data Objects and Attribute Types	https://nptel.ac.in/courses/110107092
Cluster Analysis	https://nptel.ac.in/courses/110107095

Course Code	LC-BCA-312A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Data Warehousing & Mining Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop practical knowledge of data warehousing architecture, OLAP operations, and data preprocessing techniques for effective data analysis. • To analyze association rule mining, classification, clustering, and outlier detection techniques using modern data mining tools and algorithms. • To design and implement real-world data warehousing and data mining applications for knowledge discovery and decision support systems.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply data warehousing concepts, OLAP operations, preprocessing techniques, association rule mining, classification, and clustering methods using data mining tools.	Level-3 Apply
CO2	Analyze frequent patterns, classification accuracy, clustering performance, and outlier detection techniques for multidimensional datasets.	Level-4 Analyze
CO3	Evaluate association rules, classification models, clustering methods, and data mining results using WEKA and related analytical techniques.	Level-5 Evaluate
CO4	Design and develop real-world data warehousing and data mining applications using appropriate preprocessing, mining, and visualization techniques.	Level-6 Create

Exp. No.	Experiment
1	Study of Data Warehousing architecture and OLTP vs OLAP systems.
2	Create Star Schema and Snowflake Schema for a sample data warehouse.
3	Perform OLAP operations such as Roll-up, Drill-down, Slice, Dice, and Pivot.
4	Implement data cleaning and data transformation techniques on datasets.
5	Perform data integration and data reduction using sample datasets.
6	Demonstrate data discretization and concept hierarchy generation.
7	Implement data visualization techniques for statistical data analysis.
8	Apply similarity and dissimilarity measures on multidimensional datasets.
9	Implement Apriori algorithm for association rule mining.
10	Generate frequent patterns and correlation rules using transactional datasets.

11	Implement Decision Tree classification using WEKA tool.
12	Apply Bayesian Classification and Support Vector Machine (SVM) techniques.
13	Implement clustering techniques using Partitioning and Hierarchical methods.
14	Analyze clustering performance using Density Based and Grid Based clustering methods.
15	Analyze outlier detection methods and classification accuracy improvement techniques.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	DSC-BCA-314A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Relational Database Management System				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	2	0	0	**2**	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of relational database systems, database architecture, data models, and SQL for efficient data management. • To develop understanding of database design, normalization, transaction management, concurrency control, and database security techniques. • To analyze and apply relational database concepts, advanced database technologies, and connectivity mechanisms for real-world database applications.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of database systems, relational models, SQL, normalization, transaction management, distributed databases, and advanced database technologies.	Level-1 Remember
CO2	Explain database architecture, relational algebra, SQL operations, normalization techniques, concurrency control, recovery mechanisms, and database security concepts.	Level-2 Understand
CO3	Apply SQL queries, normalization techniques, transaction management methods, database connectivity, and security mechanisms in relational database systems.	Level-3 Apply
CO4	Analyze database models, query processing, concurrency issues, recovery techniques, distributed database concepts, and emerging trends in database systems.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 marks each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction to Database Management Systems: Introduction to Database Systems, Characteristics of Database Approach, Database Users and Administrator, Advantages and Applications of DBMS, Database Environment, Data Models, Three Schema Architecture, Database Languages, Database System Architecture, Entity Relationship (ER) Model, ER Diagrams, Attributes and Relationships, Constraints in ER Model, Extended ER Model, Relational Model Concepts, Relational Algebra and Relational Calculus.

UNIT II

Structured Query Language and Database Design: Introduction to SQL, SQL Data Types, DDL Commands, DML Commands, DCL Commands and TCL Commands, Integrity Constraints, Keys and Referential Integrity, SQL Queries, Nested Queries, Join Operations, Aggregate Functions, Views, Sequences, Indexes, Assertions and Triggers, Database Design Process, Functional Dependencies, Normalization Concepts, Normal Forms – 1NF, 2NF, 3NF, BCNF, Multivalued Dependency and Join Dependency.

UNIT III

Transaction Management and Concurrency Control: Transaction Concepts, Properties of Transactions, Transaction States, Concurrent Execution of Transactions, Serializability, Concurrency Control Techniques, Lock Based Protocols, Timestamp Based Protocols, Deadlock Handling Techniques, Database Recovery Techniques, Log Based Recovery, Checkpoints, Shadow Paging, Backup and Recovery Mechanisms, Security and Authorization in Databases, Database Auditing.

UNIT IV

Advanced Database Concepts: Introduction to Distributed Databases, Distributed Database Architecture, Fragmentation and Replication, Client Server Database Architecture, Parallel Databases, Object Oriented Databases, Object Relational Databases, Data Warehousing Concepts, Data Mining Basics, NoSQL Databases, XML Databases, Database Connectivity using ODBC/JDBC, Web Databases, Database Security Issues, Emerging Trends in Database Systems.

Text Books

1. Database System Concepts, Abraham Silberschatz, Henry F. Korth and S. Sudarshan, McGraw Hill Education, 2020.
2. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, Pearson Education, 2017.
3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw Hill Education, 2003.
4. Relational Database Management Systems, N. P. Singh and C. S. Gupta, Abhishek Publications, 2014.

Reference Books

1. An Introduction to Database Systems, C. J. Date, Pearson Education, 2009.
2. Database Systems: A Practical Approach to Design, Implementation and Management**,** Thomas Connolly and Carolyn Begg, Pearson Education, 2015.
3. Fundamentals of Relational Database Management Systems, S. Sumathi and S. Esakkirajan, Springer, 2007.
4. Database Systems Design, Implementation and Management, Peter Rob and Carlos Coronel, Cengage Learning, 2007.
5. Relational Database Management System, A. D. Mankar, Nirali Prakashan, 2014.

Video Links

Topics	**Links**
Relational Model Concepts	https://nptel.ac.in/courses/106106093
Structured Query Language	https://nptel.ac.in/courses/106106220
Concurrency Control	https://nptel.ac.in/courses/106104135
Client Server Database Architecture	https://www.youtube.com/watch?v=AAKUqHBuzk4&t=35s

Course Code	LC-BCA-316A				
Category	Discipline- Specific Courses Major Courses				
Course Title	Relational Database Management System Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	4	**2**	
Course Objectives	The objectives of this course are • To develop practical knowledge of relational database concepts, SQL programming, normalization techniques, and transaction management for database applications. • To analyze database processing, concurrency control, recovery techniques, distributed database concepts, and security mechanisms in relational database systems. • To design and implement real-world relational database applications using appropriate database design, connectivity, and security techniques.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply relational database concepts, SQL commands, normalization techniques, transaction management, and database connectivity for database applications.	Level-3 Apply
CO2	Analyze transaction processing, concurrency control, recovery mechanisms, distributed database concepts, and database security issues.	Level-4 Analyze
CO3	Evaluate database performance, normalization efficiency, query processing methods, and security mechanisms in relational database systems.	Level-5 Evaluate
CO4	Design and develop real-world relational database applications with proper schema design, integrity constraints, security, and connectivity features.	Level-6 Create

Exp. No.	Experiment
1	Study of DBMS architecture, database users, and relational database concepts.
2	Create ER diagrams for real-world database applications.
3	Implement relational schema and perform table creation using SQL commands.
4	Apply DDL commands for database and table management.
5	Apply DML commands for insertion, updation, deletion, and retrieval of records.
6	Implement SQL queries using operators, aggregate functions, and clauses.
7	Implement different types of joins and nested queries in SQL.
8	Create views, indexes, sequences, and triggers in SQL.
9	Apply integrity constraints and referential integrity in relational databases.

10	Perform normalization up to BCNF for database design.
11	Implement transaction management and TCL commands in SQL.
12	Demonstrate concurrency control and locking mechanisms in databases.
13	Implement database connectivity using ODBC/JDBC.
14	Analyze transaction processing, deadlock handling, and recovery mechanisms in database systems.
15	Analyze distributed database concepts, database security issues, and query processing techniques.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**MICV- 308A**				
Category	Major Discipline Relevant Course (Vocational) – Minor				
Course Title	Entrepreneurship Development				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	**4**	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts, theories, and role of entrepreneurship in economic development. • To develop the ability to identify business opportunities through creative thinking and feasibility analysis. • To equip students with skills to design functional plans including organizational, financial, and operational aspects of a venture. • To understand various sources of finance and legal aspects including Intellectual Property Rights (IPR) relevant to entrepreneurship.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define entrepreneurship concepts, theories, entrepreneurial process, traits of entrepreneurs, business idea generation, feasibility analysis, functional planning, and sources of finance including IPR.	Level-1 Remember
CO2	Explain the entrepreneurial environment in India, factors affecting entrepreneurship, feasibility study components, business planning, organizational structure, financial planning, and funding.	Level-2 Understand
CO3	Apply creative thinking techniques to generate business ideas, conduct feasibility studies, prepare business plans, design organizational structures, and select appropriate funding sources.	Level-3 Apply
CO4	Analyze entrepreneurial opportunities, environmental factors, financial viability, organizational design, and various financing options.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

UNIT – I

Entrepreneurship:- Concept, theories, process, Growth of entrepreneurship environment in India, Traits of successful entrepreneurs; Managerial vs. entrepreneurial approach

UNIT – II

Starting the venture:-Creative thinking, Business idea generation (Business cases on entrepreneurship),

Environmental scanning pertaining to business idea: Feasibility study: Market feasibility, Technical/ Feasibility operations, financial feasibility, Project Report.

UNIT – III

Functional Plans:- Drawing a business plan, selecting organization type for business, Organization structure and Job designs, Designing financial plan: Investment, Incomes and Expenditure, Banking and Accounts, understanding profitability.

UNIT – IV

Sources of Finance:- understanding Financial Framework: Debt Equity Financing, Commercial banks, Venture Capital, Financial institutions supporting entrepreneurs, Angel investors. Understanding IPR: Patents, Trademarks, Copy rights, Trade secrets, Licensing, Franchising.

Suggested Readings:

- Entrepreneurship Development & Small Business Enterprises by Charantimath, Poornima, , Pearson
  Education.
- Entrepreneurship by Hisrich, Robert D., Michael Peters and Dean Shephered, Tata McGraw Hill, New Delhi
- Entrepreneurship by Barringer, Brace R., and R. Duane Ireland, Pearson Education.
- Entrepreneurship by Lall, Madhurima, and Shikha Sahai, Excel Books, New Delhi.
- Entrepreneurship by Kuratko, Donand and Richard Hodgetts, Cengage Learning India Pvt. Ltd., New Delhi

Useful Video links:

Topics	**Links**
Entrepreneurship Concepts & Environment	https://nptel.ac.in/courses/110106141
Starting the Venture & Feasibility Study	https://nptel.ac.in/courses/110106141/lecture-05
Functional Plans & Business Plan	https://nptel.ac.in/courses/110106141/lecture-12
Sources of Finance & IPR	https://nptel.ac.in/courses/110105139

Course Code	MICV-310A				
Category	Major Discipline Relevant Course (Vocational) - Minor				
Course Title	Web Development				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of web technologies, Internet concepts, HTML, CSS, and JavaScript for web page development. • To develop understanding of web page designing, styling techniques, and client-side scripting used in modern websites. • To apply and analyze basic web development concepts for creating simple, responsive, and interactive web pages.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of web technology, HTML, CSS, JavaScript, websites, web pages, and web development tools.	Level-1 Remember
CO2	Explain HTML tags, web page structure, CSS styling techniques, and basic JavaScript concepts used in web development.	Level-2 Understand
CO3	Apply HTML, CSS, and JavaScript techniques to create and design simple web pages and forms.	Level-3 Apply
CO4	Analyze web page structure, styling methods, responsive layouts, and client-side scripting techniques for web applications.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Basics of Web Technology: Introduction to Internet, World Wide Web (WWW), Web Browsers, Web Servers, Websites and Web Pages, Static and Dynamic Websites, URL and Domain Name, Web Hosting Basics, Client Server Architecture, Introduction to Web Development Tools and Editors.

UNIT II

HTML Basics: Introduction to HTML, Structure of HTML Document, Basic HTML Tags, Heading and Paragraph Tags, Text Formatting Tags, Lists in HTML, Hyperlinks, Images, Tables, Frames, Forms and Form Controls, HTML Attributes, Introduction to HTML5.

UNIT III

Advanced HTML and CSS: HTML5 Audio and Video Tags, Semantic Tags, Introduction to CSS, Types of CSS, CSS Selectors, Colors, Backgrounds, Fonts, Borders, Margins and Padding, CSS Box Model, Styling Tables and Forms, Introduction to Responsive Web Pages.

UNIT IV

CSS and JavaScript Basics: CSS Positioning and Layout, Navigation Bar Design using CSS, Introduction to JavaScript, Variables and Data Types, Operators, Conditional Statements, Looping Statements, Functions, Arrays, Event Handling, Form Validation using JavaScript, Introduction to DOM.

Text Books

1. Web Technologies, Uttam K. Roy, Oxford University Press, 2011.
2. HTML and CSS: Design and Build Websites, Jon Duckett, Wiley India, 2017.
3. Web Programming, Chris Bates, Wiley Dreamtech, 2009.
4. Internet and Web Technology, Raj Kamal, Tata McGraw Hill, 2007.

Reference Books

1. Programming the World Wide Web, Robert W. Sebesta, Pearson Education, 2016.
2. Beginning HTML, XHTML, CSS and JavaScript, Jon Duckett, Wiley Publications, 2010.
3. JavaScript: The Complete Reference, Thomas A. Powell and Fritz Schneider, McGraw Hill, 2013.
4. Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, Ivan Bayross, BPB Publications, 2010.
5. Learning Web Design, Jennifer Niederst Robbins, O'Reilly Media, 2018.

Video Links

Topics	Links
Introduction to Internet	https://nptel.ac.in/courses/106105082
World Wide Web (WWW), Web Browsers	https://nptel.ac.in/courses/106105084
HTML	https://www.youtube.com/watch?v=QEtWL4lWlL4&t=984s
CSS	https://www.youtube.com/watch?v=h_RftxdJTzs
Java Script	https://www.youtube.com/watch?v=uUhOEj4z8Fo&t=568s

Course Code	LC-MICV-312A				
Category	Major Discipline Relevant Course (Vocational) - Minor				
Course Title	Web Development Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop practical skills in creating web pages using HTML elements, forms, tables, multimedia, and semantic tags. • To analyze and apply CSS styling, responsive layouts, and JavaScript functionalities for interactive web page design. • To design and develop simple responsive websites using HTML, CSS, and JavaScript technologies.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply HTML, CSS, and JavaScript concepts to create and design basic web pages and forms.	Level-3 Apply
CO2	Analyze web page structures, CSS layouts, responsive design techniques, and client-side scripting functionalities.	Level-4 Analyze
CO3	Evaluate web page design, styling methods, and JavaScript validation techniques for effective web development.	Level-5 Evaluate
CO4	Design and develop responsive and interactive websites using HTML, CSS, and JavaScript technologies.	Level-6 Create

Exp. No.	Experiment
1	Study of Internet, web browsers, web servers, and website structure.
2	Create a simple web page using basic HTML tags.
3	Design a web page using text formatting tags, lists, and hyperlinks.
4	Create web pages using images, tables, and frames in HTML.
5	Design HTML forms using different form controls.
6	Create web pages using HTML5 semantic tags.
7	Implement audio and video embedding in HTML5 web pages.
8	Apply internal, external, and inline CSS in web pages.
9	Design web pages using CSS colors, fonts, borders, margins, and padding.
10	Create responsive web pages using CSS layout and positioning techniques.
11	Design navigation bars and styled forms using CSS.
12	Implement JavaScript variables, operators, and control statements.
13	Develop programs using JavaScript functions and arrays.
14	Design and develop a simple responsive website using HTML, CSS, and JavaScript.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	RP-BCA-322A				
Category	Project				
Course Title	Project				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	0	**4**	
Course Objectives	The objectives of this course are to • Develop project planning and management skills for successful technical execution. • Enhance software development, database design, and system integration capabilities. • Apply structured problem-solving methods to resolve complex technical issues. • Improve professional communication skills, both written and verbal. • Understand and apply ethical principles in software engineering practices				
Assessment	25 Marks				
End Semester Examination	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify emerging technologies and interdisciplinary fields for hands-on industrial training.	Level-1 Remember
CO2	Describe report writing and presentation skills in technical and industrial contexts.	Level-2 Understand
CO3	Apply engineering principles to analyze and solve real-world industrial problems.	Level-3 Apply
CO4	Assess ethical standards and tools across diverse technological domains.	Level-4 Analyze
CO5	Evaluate personal performance in communication, teamwork, and technical proficiency.	Level 5: Evaluate
CO6	Design and develop industry-relevant software or hardware systems.	Level 6: Create

Overview:

Project is a foundational course that introduces students to the research process in computer science and information technology. This course provides students with the necessary skills and knowledge to undertake independent research projects. Students will learn to identify research problems, conduct literature reviews, design research methodologies, collect and analyze data, and present their findings effectively.

The project evaluation is designed in accordance with Outcome-Based Education (OBE) principles. The assessment is divided into **Internal Assessment (25%)** and **External Assessment (75%)**, ensuring continuous evaluation and comprehensive measurement of student performance across multiple stages.

Project Evaluation Scheme

1. Assessment Framework

Sr. No.	Exam Type	Stage No.	Criteria	Assessment	Marks	Overall Weightage
1	**Internal**	**Stage-I**	Project Synopsis	Rubric I	12	Stage I to II = 25%
2		**Stage-II**	Presentation–I	Rubric II	13	
3	**External/End Semester Exam**	**Stage-III**	Project Understanding & Technical Knowledge (20 Marks)	Rubric III	75	Stage III = 75%
			Methodology & Design Approach (20Marks)			
			Implementation Progress & Demonstration (20 Marks)			
			Innovation & Problem Solving (20 Marks)			
			Viva–Voce & Technical Skills(20 Marks)			
Total					100	100%

2. Internal Assessment (25 Marks – 25%)

The internal evaluation is carried out in two progressive stages to monitor student performance, project development, and continuous improvement.

Rubric I: Project Synopsis (Stage-I)					
Parameters/Assessment Levels	**Excellent**	**Good**	**Average**	**Poor**	**Marks**
Project Definition & Problem Identification (03 Marks)	03: Problem, objectives and scope are clearly defined.	02: Problem and objectives are adequately defined.	01: Limited clarity in problem definition.	01-00: Problem is unclear or poorly defined.	
Literature Review (03 Marks)	03: Comprehensive review using relevant and credible references.	02: Adequate review with relevant references.	01: Limited review with few references.	00: Inadequate or irrelevant references.	
Technical & Domain Understanding (03 Marks)	03: Demonstrates strong domain and technical understanding.	02: Demonstrates good understanding with minor gaps.	01: Demonstrates basic understanding.	00: Demonstrates poor understanding.	
Impact on Society & Relevance to POs/PSOs (02 Marks)	02: Strong societal/technical relevance with clear alignment.	01: Reasonable relevance and alignment.	0.5: Limited relevance or alignment.	00: No clear relevance or alignment.	
Presentation & Communication (01 Marks)	01: Clear, organized, and professional presentation.	0.75: Satisfactory presentation with acceptable clarity.	0.5: Presentation lacks clarity.	00: Poorly organized presentation.	
Total Marks					12

Rubric II: Presentation -I (Stage-II)						
Sr. No.	**Parameters/Assessment Levels**	**Excellent**	**Good**	**Average**	**Poor**	**Marks**
1	**Problem Understanding & Planning (03 Marks)**	03: Problem, objectives, and planning are clearly defined.	02: Adequate understanding and planning.	01: Limited planning and clarity.	00: Poor understanding and planning.	
2	**Design Methodology & Feasibility (03 Marks)**	03: Methodology is justified and technically feasible.	02: Methodology is appropriate with acceptable feasibility.	01: Methodology is partially defined.	00: Methodology lacks clarity or feasibility.	
3	**Implementation Strategy & Timeline (02 Marks)**	02: Implementation plan and timeline are clearly defined.	01: Implementation strategy is satisfactory.	0.5: Limited implementation planning.	00: Implementation strategy is unclear.	
4	**Preliminary Progress & Requirement Fulfillment (03 Marks)**	03: Significant progress aligned with objectives.	02: Moderate progress toward objectives.	01: Limited progress achieved.	00: Minimal or no progress demonstrated.	
5	**Technical Presentation & Communication (02 Marks)**	02: Presentation is technically sound and professional.	1.5: Presentation is satisfactory.	01: Presentation lacks clarity.	00: Presentation is ineffective.	
Total Marks						13

External Assessment (75 Marks – 75%)

Rubric III: External/End Semester Exam (Stage-III)						
Sr. No.	**Parameters / Assessment Levels**	**Excellent**	**Good**	**Average**	**Poor**	**Marks**
1	**Project Understanding & Technical Knowledge (15 Marks)**	15-13: Excellent understanding of concepts, methodology, and technical aspects.	12-10: Good understanding with reasonable clarity.	09-06: Satisfactory understanding with limited clarity.	05-00: Poor understanding of project concepts.	
2	**Methodology & Design Approach (15 Marks)**	15-13: Methodologies are clearly justified and technically sound.	12-10: Methodology is appropriate with minor refinements needed.	09-06: Methodology is partially defined.	05-00: Methodology lacks clarity.	
3	**Implementation Progress & Demonstration (15 Marks)**	15-13: Significant implementation progress demonstrated effectively.	12-10: Moderate progress with acceptable demonstration.	09-06: Limited implementation progress.	05-00: Minimal or no implementation progress.	
4	**Innovation & Problem Solving (15 Marks)**	15-13: Strong innovation and effective problem-solving approach.	12-10: Good innovation with acceptable problem-solving.	09-06: Limited innovation or analytical thinking.	05-00: Lacks innovation and problem-solving approach.	
5	**Viva–Voce (15Marks)**	15-13: Answers confidently with technical justification.	12-10: Answers most questions satisfactorily.	09-06: Partial responses with basic understanding.	05-00: Unable to answer satisfactorily.	
Total Marks						75

Annexure AC/5.40

Annexure 4.5

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

SCHEME OF EXAMINATIONS AND SYLLABI
OF
3-4 YEARS
BACHELOR OF COMPUTER APPLICATIONS
(BCA)
WITH EFFECT FROM THE
SESSION 2026-27

1st Semester onwards (Students Admitted in 2026-27)
&
3rd Semester onwards (Students Admitted in 2025-26)

Approved by AICTE, New Delhi and Affiliated to MDU, Rohtak

GENERAL COURSE STRUCTURE & THEME

1. **DEFINITION OF CREDIT:**

1	1 Hr. Lecture (L) per week	1 Credit
2	1 Hr. Tutorial(T) per week	1 Credit
3	1 Hr. Practical(P) per week	0.5Credit
4	2 Hr. Practical(P) per week	1 Credit

2. **COURSE CODE AND DEFINITION:**

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
CC	Core Courses
AEC	Ability Enhancement Courses
MDE	Multi-Disciplinary Elective Courses
VAC	Value Added Courses
SEC	Skill Enhancement Courses
DSE	Discipline Specific Elective
OE	Open Elective
LC	Lab Courses
INT	Summer Internship Report/ Capstone Project
RP	Project Report/Research Project/Dissertation

COURSE NAME: Bachelor in Computer Application, Bachelor in Computer Application (Honours) and Bachelor in Computer Application (Honours with Research)

COURSE LEVEL/ DURATION/SYSTEM:

Undergraduate / Three or Four years/ 6 or 8 Semesters with multiple entry and exit. The following option will be made available to the students joining BCA Research Program:

a. **One Year:** Under Graduate Certificate in Computer Application
b. **Two Years**: Under Graduate Diploma in Computer Application
c. **Three years**: Bachelor in Computer Application(BCA)
d. **Four years**: Bachelor in Computer Application with Honours: BCA (Honours)/ BCA (Honours) with specialization in AIML/ BCA (Honours) with specialization in Data Science /Bachelor in Computer Application Honours with Research: BCA (Honours with Research)

MINIMUM ELIGIBILITY CRITERIA:

Minimum eligibility criteria for opting the course in the fourth year will be as follows:

1. **BCA (Honours with Research):** Minimum 75% marks or equivalent CGPA in BCA Degree up to Sixth Semester.
2. **For BCA (Honours)** : BCA Degree Completion of 3-Year BCA Degree

Note: The students who are eligible for BCA (Honours with Research) shall have choice to pursue either BCA (Honours) or BCA (Honours with Research).

EXISTING CREDIT STRUCTURE EFFECTIVE FROM2025-26

SEMESTER WISE CREDIT DISTRIBUTION:

SEMESTER WISE CREDIT DISTRIBUTION OF PROPOSED [BCA/BCA (HONOURS)/ BCA (HONOURS WITH RESEARCH)] PROGRAM:

Semester	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective Course	Value Added Courses	Skill Enhancement Courses	Discipline Specific Elective	Total
I	8	2	2	2	7	-	21
II	14	-	-	2	5	-	21
III	11	0	0	2	4	3	20
IV	15	0	0	0	2	3	20
V	0	0	0	0	6	15	21
VI	4	1	0	0	4	10	19
TOTAL							122*
*Minor Variation are allowed as per the need of program.							
BCA (Honours)							
VII	5	0	3	0	4	8	20
VIII					8	12	20
BCA (Honours with Research)							
VII	12					8	20
VIII	20						20

Category-Wise Distribution

Description	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective Course	Value Added Courses	Skill Enhance-ment courses	Discipline Specific Elective	Total
BCA	52	3	2	6	28	31	122
BCA (Honours)	57	3	5	6	40	51	162
BCA (Honours with Research)	84	3	2	6	28	39	162
3 Years BCA Program					**Total Credits=122***		
4 Years BCA (Honours) and BCA (Honours with Research)					**Total Credits=162***		

REVISED(1st YEAR ONLY) CREDIT STRUCTURE EFFECTIVE FROM2026-27

SEMESTER WISE CREDIT DISTRIBUTION:

SEMESTER WISE CREDIT DISTRIBUTION OF PROPOSED [BCA/BCA (HONOURS)/ BCA (HONOURS WITH RESEARCH)] PROGRAM:

Semester	Core Courses	Ability Enhance-ment Courses	Multi-Disciplinary Elective Course	Value Added Courses	Skill Enhancement Courses	Discipline Specific Elective	Total
I	**8**	**2**	**2**	**2**	**5**	**-**	**19**
II	**12**	**-**	**-**	**2**	**7**	**-**	**21**
III	11	0	0	2	4	3	20
IV	15	0	0	0	2	3	20
V	0	0	0	0	6	15	21
VI	4	1	0	0	4	10	19
TOTAL							**120**
BCA (Honours)							
VII	5	0	3	0	4	8	20
VIII					8	12	20
BCA (Honours with Research)							
VII	12					8	20
VIII	20						20

Category-Wise Distribution

Description	Core Courses	Ability Enhancement Courses	Multi- Disciplinary Elective Course	Value Added Courses	Skill Enhance-ment courses	Discipline Specific Elective	Total
BCA	50	3	2	6	28	31	120
BCA (Honours)	55	3	5	6	40	51	160
BCA (Honours with Research)	82	3	2	6	28	39	160
3 Years BCA Program					**Total Credits=120***		
4 Years BCA (Honours) and BCA (Honours with Research)					**Total Credits=160***		

Minor Variations are allowed as per the need of program.

Note: Students can take extra credit course from their own department or from other department as per the Institute norms.

Induction Program (Mandatory)

A 3-week Student Induction Program has to be conducted at the start of the first year to familiarize students with the academic environment, develop soft skills, and promote holistic learning.

Components Include:

- Physical Activities & Fitness
- Creative Arts & Literary Activities
- Universal Human Values and Ethics
- Language & Proficiency Modules
- Expert Lectures – at least one per semester
- Industrial Visits – one per semester
- Orientation with Department, Branch, and Innovations

Mandatory Academic Activities

1. Industrial Visits: One per semester
2. Workshops: One-week professional/industry/entrepreneurial workshop after the 5th semester
3. Expert Lectures: At least one per semester by industry/domain experts

Summer Internship / Projects/Seminar etc.

Evaluation includes Work Done, Project Report, Presentation, and Viva-Voce

Internal Assessment Includes:

- Class Participation and Performance
- Attendance
- Assignments & Quizzes
- Lab Records & Practical Viva-Voce
- Mid-Semester Tests (Best 2 out of 3 considered)

Scheme of Studies and Examination
BCA –1st Semester
w.e.f 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Assessment	End Semester Examination		Total
										Theory	Practical	
3 WEEKS COMPULSORY INDUCTION PROGRAM												
1	Core Courses	CC-BCA-101B	Mathematics Foundations to Computer Science - I	3	0	0	3	3	25	50	-	75
2	Core Courses	CC-BCA-103B	Computer Architecture	3	0	0	3	3	25	50	-	75
		LC-BCA-107B	Computer Architecture Lab	0	0	4	4	2	15	-	35	50
3	Skill Enhancement Courses	SEC-BCA-101B	Problem Solving Techniques	3	0	0	3	3	25	50	-	75
		LC-BCA-109B	Problem Solving Techniques Lab	0	0	4	4	2	15	-	35	50
4	Multidisciplinary Courses	----------	Refer Table No.-I (Multidisciplinary Courses-Indian Knowledge Systems)	2	0	0	2	2	15	35	-	50
5	Ability Enhancement Course	AEC-BCA-101B	General English	2	0	0	2	2	15	35	-	50
6	Value Added Courses	VAC-BCA-101B	Environmental Science and Sustainability	2	0	0	2	2	15	35	-	50
7	Additional Courses	AEC-BCA-103B	Foreign Language French	1	1	0	-	-	50*	-	-	50*
Total Credits								**19**				**475**

Scheme of Studies and Examination
BCA – 2nd Semester
w.e.f 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load PerWeek	Credits	Examination Schedule (Marks)			
				L	T	P			Assessment	End Semester Examination		Total
										Theory	Practical	
1	Core Courses	CC-BCA-102B	Mathematics Foundations to Computer Science-II	3	0	0	3	3	25	50	-	75
2	Core Courses	CC-BCA-104B	Data Structures	3	0	0	3	3	25	50	-	75
		LC-BCA-108B	Data Structures Lab	0	0	4	4	2	15	-	35	50
3	Core Courses	CC-BCA-110B	Operating Systems	3	0	0	3	3	25	50	-	75
		LC-BCA-114B	Operating Systems Lab	0	0	2	2	1	10	-	15	25
4	Skill Enhancement Courses	SEC-BCA-102B	Object Oriented Programming using Java	3	0	0	3	3	25	50	-	75
		LC-BCA-118B	Object Oriented Programming using Java Lab	0	0	4	4	2	15	-	35	50
5	Skill Enhancement Courses	SEC-BCA-104B	Web Technologies	1	0	0	1	1	05	20	-	25
		LC-BCA-120B	Web Technologies Lab	0	0	2	2	1	10	-	15	25
6	Value Added Courses	VAC-BCA-102B	Indian Constitution	2	0	0	2	2	15	35	-	50
7	Additional Courses	AEC-BCA-102B	Indian Language Hindi	1	1	0	-	-	50*	-	-	50`*
Total Credits								**21**				**525**

Semester-I

Table No. I (Multidisciplinary Courses-Indian Knowledge System)

S. No.	Category	Course Code	Course Name
1.	Multidisciplinary Courses	MDE-101B	Indian Knowledge Systems and Traditions
2.	Multidisciplinary Courses	MDE-103B	Indian Mathematics and Astronomy
3.	Multidisciplinary Courses	MDE-105B	Indian Vision for Human Society
4.	Multidisciplinary Courses	MDE-107B	Indian Culture and Civilization
5.	Multidisciplinary Courses	MDE-109B	Indian Science, Engineering and Technology
6.	Multidisciplinary Courses	MDE-111B	Indian Town Planning and Architecture
7.	Multidisciplinary Courses	MDE-113B	Indian Health, Wellness and Psychology

Note:
After Year 1, Students are advised to take Social Responsibility & Community Engagement - encompassing Community Engagement with an NGO in the vacation time.
An UNDER GRADUATE CERTIFICATE IN COMPUTER APPLICATION will be awarded, if a student wishes to exit at the end of First year.

Exit Criteria after First Year of BCA Programme
Students will have the option to exit the Bachelor of Computer Application (BCA) program after successfully completing the first year. Upon exit, they will be awarded a **UG Certificate in Computer Application**. To be eligible for this certificate, students must complete **an additional 04 credits** in one of the following are as:

1. **Skill-Based Subject:** A course designed to enhance practical and technical skills in the field of computer applications.
2. **Work-Based Vocational Course**: A vocational course offered during the summer term that emphasizes hands-on training and workplace readiness.
3. **Internship/Apprenticeship**: A professional internship or apprenticeship program in a relevant field, with a minimum duration of 08 weeks, which will take place after the second semester.
4. **Social Responsibility & Community Engagement**:Active engagement with an NGO or community organization for a minimum duration of 08 weeks, focusing on real-world problem-solving, social responsibility, and community service.
   The mode and specifics of these additional credits will be determined by the Institute**,** and students will be required to complete the 08-week program during the summer term following their second semester.
   The exiting students will clear the subject / submit the Internship Report as per the Institute schedule.

Assessment Criteria

1. The duration of all the end-term theory examinations shall be 3 hours.
2. The Criteria for awarding the formative assessment for BCA throughout the program:
a) Sessional Examination: 50 %
b) Assignments/ Presentations/ Seminars and Class Participation: 30%
c) Attendance: 20%
(Less than 65% - 0 marks; Up to 70% - 2 marks; up to 75% - 3 marks; up to 80% - 4 marks; above 80% - 5 marks)
3. The panel of examiners for end-semester theory and practical examinations shall be prepared and approved by the BOS, comprising internal and external examiners based on their expertise, specialization, and area of interest.
4. The assessment criteria for **Lab Courses** will be as follows:

Evaluation Scheme for Practical/Lab Examination: 25Marks

		Marks Distribution
Program 1	Flowchart/Algorithm	01
	Writing Program	01
	Execution and Program Format	02
Program 2	Flowchart/Algorithm	01
	Writing Program	01
	Execution and Program Format	02
Viva Voce		07
Practical File*		05
Attendance*		05
Total		**25**

*Marks to be provided by Internal Teacher.

Evaluation Scheme for Practical/Lab Examination: 50Marks

		Marks Distribution
Program 1	Flowchart/Algorithm	02
	Writing Program	03
	Execution and Program Format	05
Program 2	Flowchart/Algorithm	02
	Writing Program	03
	Execution and Program Format	05
Viva Voce		15
Practical File*		10
Attendance*		05
Total		**50**

*Marks to be provided by Internal Teacher.

5.An '**Additional Course'** is a non-credit Ability-Enhancement Course that is undertaken for learning purposes only. If completed, the '**Additional Course'** may be recorded. The **Additional Course (Ability Enhancement Course)** is included as a qualifying paper and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

For one credit theory and one credit tutorial (1:1:0)

	Marks Distribution
Written test (2X5)	10
Peer discussion/Debate /Extempore speech(2X10)	20
Role play	05
Essay/Article/Report writing	10
Attendance	05
Total	**50**

Course code	**CC-BCA-101B**				
Category	Core Course				
Course title	**Mathematics Foundation to Computer Science - I**				
Scheme and Credits	L	T	P	**Credits**	Semester-I
	3	0	0	**3**	
Course Objectives:	The objectives of this course are ● Enable a strong foundation in sets, relations, functions, counting techniques, recurrence relations, and graph theory for solving discrete mathematical problems. ● Build proficiency inmatrix algebra and its applications, including solving systems of equations and understanding eigen values and related concepts.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

CO	Skill Demonstrated	Level
CO1	**Define** fundamental concepts of sets, relations, functions, counting techniques, graph theory, and matrix algebra**.**	Level-1Remember
CO2	**Explain** properties and representations of relations, functions, graphs, recurrence relations, and matrices**.**	Level-2Understand
CO3	**Apply** appropriate methods to solve problems involving set operations, counting techniques, recurrence relations, graph traversal, and matrix operations**.**	Level-3Apply
CO4	**Analyze** mathematical structures such as equivalence relations, graph properties, recurrence solutions, and systems of linear equations using matrices and eigen concepts.	Level-4Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Set, Relation and Function:

Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, Closures of
Relations, Warshall's algorithm. Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions. Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.

UNIT – II

Counting and Recurrence Relation:

Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem. Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. Solving linear recurrence relation with constant coefficients using characteristic equation roots method.

UNIT – III

Elementary Graph Theory:

Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, Euler and Hamiltonian graphs. Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.

UNIT – IV

Matrix Algebra:

Types of matrices, algebra of matrices–addition, subtraction, and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen values and Eigen vectors, Caley-Hamilton theorem.

Reference Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Publishing Company, 2024. (AICTE Recommended Textbook)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Publishing Company,2023.
3. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
4. Deo Narsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979.
5. Vasishtha A. R. and Vasishtha A. K., Matrices, Krishna Prakashan, 2022. Reference Books
6. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.
7. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
8. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015

Video Links

Topics	Links
Set, Relation and Function	https://nptel.ac.in/courses/106103205
Counting and Recurrence Relation	https://nptel.ac.in/courses/111101115
Elementary Graph Theory	https://nptel.ac.in/courses/111101115
Matrix Algebra	https://nptel.ac.in/courses/111101115

Course Code	**CC-BCA-103B**				
Category	Core Courses				
Course Title	**Computer Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● Understand fundamental concepts of digital electronics, number systems, and logic circuits. ● Design and implement combinational and sequential circuits using standard methods and components. ● Analyze the operation of computer organization, memory systems, and input-output mechanisms.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of digital logic, number systems, combinational and sequential circuits, and computer organization.	Level-1 Remember
CO2	Explain Boolean simplification methods, arithmetic operations, and the functioning of registers, counters, and CPU organization.	Level-2 Understand
CO3	Apply logic design techniques to construct combinational/sequential circuits and perform number system conversions and arithmetic operations.	Level-3 Apply
CO4	Analyze pipelining, memory hierarchy, input-output organization, and overall computer system performance.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Digital Principles: Definition for Digital signals, Digital logic, Digital computers, Von Neumann Architecture, Boolean Laws and Theorems, K-Map: Truth Tables to K-Map, 2, 3 and 4 variable K Map, K-Map Simplifications, Don't Care Conditions, SOP and POS.

Number Systems: Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess3 Code, The Gray Code.

UNIT – II

Combinational Circuits: Half Adder and Full Adder, Subtractor, Decoders, Encoder, Multiplexer, Demultiplexer.

Sequential Circuits: Flip-Flops- SR Flip- Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop.

Register: 4 bit register with parallel load, Shift Registers- Bidirectional shift register with parallel load Binary Counters-4 bit synchronous and Asynchronous binary counter.

UNIT – III

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input Output Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator logic. Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC), RISC Vs CISC.

UNIT – IV

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor(IOP). Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Reference Books

- Donald P Leach, Albert Paul Malvino, Goutam Saha- “Digital Principles & Applications” , Tata McGraw Hill Education Private Limited,2011Edition.
- M. Morris Mano- “Computer System Architecture”, Pearson/Phi, Third Edition.
- William Stallings- “Computer Organization and Architecture”, Pearson/PHI, Sixth Edition,
- Andrew S. Tanenbaum- “Structured Computer Organization”, PHI /Pearson 4th Edition,
- M. V . Subramanyam, “Switching Theory and Logic Design”, Laxmi Publications (P) Ltd.
- Ikvinderpal Singh, Computer Organization Architecture, Khanna Book Publishing.

Video Links

Topics	Links
Number Systems	https://nptel.ac.in/courses/106102157
Decoders	https://nptel.ac.in/courses/106102229
Computer Organization and Design	https://nptel.ac.in/courses/106102062
Pipeline and Vector Processing	https://nptel.ac.in/courses/106102157

Course Code	**LC-BCA-107B**				
Category	Core Courses				
Course Title	**Computer Architecture Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	0	0	4	**2**	
Course Objectives	The objectives of this course are • Understand the operation of basic logic gates, flip-flops, counters, and combinational and sequential circuits. • Design, implement, and verify digital circuits such as adders, subtractors, multiplexers, encoders, registers, and shift registers. • Develop practical skills in computer hardware identification, system configuration, troubleshooting, and software installation.				
Assessment	15Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Apply** logic gates, flip-flops, K-Map simplification, and number system concepts to verify digital circuits.	Level-3 Apply
CO2	**Analyze** the behavior of combinational and sequential circuits along with computer hardware components and system operations.	Level-4 Analyze
CO3	**Evaluate** the correctness and performance of digital circuit designs and computer system configurations through testing and troubleshooting.	Level-5 Evaluate
CO4	**Create** and implement digital circuits and basic computer system setups including adders, counters, registers, and PC assembly.	Level-6 Create

List of Experiments:

EXP. No.	Experiments
1.	Verify logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates.
2.	To study and verify NAND as a Universal Gate.
3.	To verify De- Morgan's theorem for 2 variables.
4.	Design and test of an S-R flip-flop using NAND/NOR gate.
5.	Convert BCD to Excess-3 code using NAND gate.
6.	To Convert Binary to Grey Code.
7.	Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate.
8.	Realize Decoder and Encoder circuit using Basic Gates.
9.	Design and implement the 4:1 MUX using gates.
10.	Design and verify operation of half adder and full adder.
11.	Design and Implement a 4 bit shift register using Flip flops.
12.	Design and Implement a 4 bit synchronous counter.
13.	Design and verify 4 bit asynchronous counter.

14.	Identify and Troubleshoot the problems of RAM, SMPS and motherboard.
15.	To Study mother board layout of a system.
16.	Demonstrate the assembly of a PC.
17.	Install and configure windows OS.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**SEC-BCA-101B**				
Category	Skill Enhancement Courses				
Course Title	**Problem Solving Techniques**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	3	0	0	**3**	
Course Objectives	**The objectives of this course are** • To develop problem-solving skills using algorithms, flowcharts, and structured approaches. • To understand and implement programming concepts using C language, including control structures, data types, and arrays. • To design modular programs using functions and recursion for solving numerical and computational problems.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** the concepts of problem solving, algorithms, C programming fundamentals, number-based programming, and modular programming.	Level-1 Remember
CO2	**Explain** problem-solving techniques, C programming constructs, number-based programming, functions, arrays, and modular programming concepts.	Level-2 Understand
CO3	**Apply** algorithms, C programming constructs, functions, arrays, recursion, searching, sorting, and string handling to solve computational problems.	Level-3 Apply
CO4	**Analyze** algorithms with C programs to evaluate logic, correctness, efficiency, and debugging of solutions to computational problems.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Problem Solving: Problem solving concepts, problem analysis, computational problems, algorithms, algorithm efficiency and correctness, problem-solving steps, input/output specification, input validation, pre/post conditions, and role of data structures.

UNIT – II

Programming Fundamentals and C Basics: Structured programming (sequence, selection, iteration), algorithms, pseudo code, flowcharts, pattern and series problems, data representation, introduction to C language, data types, operators, input/output, control statements, program development, testing, and coding practices.

UNIT – III

Number-Based Programming: Programming on numbers (palindrome, prime, Armstrong, perfect, factorial, number conversion, etc.), statistical operations using loops, and C language constructs including else-if ladder, switch, increment/decrement, break, and continue.

UNIT – IV

Functions and Arrays: Modular programming, recursion, functions, one- and two-dimensional arrays, searching, any one sorting algorithm, matrix operations, string handling, operators, precedence, associativity and debugging.

Reference Books

- Venkatesh, Nagaraju Y, Practical C Programming for Problem Solving, Khanna Book Publishing Company, 2024.
- AICTE's Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company, 2024.
- Harvey Deitel and Paul Deitel, C How to Program, 9th edition, Pearson India, 2015.
- R G Dromey, How to Solve It by Computer.
- Brian W. Kernighan and Dennis Ritchie, The C Programming Language, 2nd edition, Pearson, 2015.
- Jeri Hanly and Elliot Koffman, Problem Solving and Program Design in C, 8th edition, Pearson, 2015.

Video Links

Topics	Links
Problem Solving	https://nptel.ac.in/courses/106104074
C Language	https://nptel.ac.in/courses/106105171
Structured Programming Concepts	https://nptel.ac.in/courses/106104074
Two-Dimensional Array	https://nptel.ac.in/courses/106105171

Course Code	**LC-BCA-109B**				
Category	Skill Enhancement Courses				
Course Title	**Problem Solving Techniques Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	0	0	4	**2**	
Course Objectives	The objectives of this course are • To understand fundamental programming concepts including variables, data types, control structures, loops, and functions for solving basic computational problems. • To understand algorithmic approaches for solving mathematical problems, pattern generation, and number-based computations using iterative techniques. • To understand modular programming and recursion techniques for designing efficient solutions to problems involving arrays, strings, matrices, and numerical operations.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Apply** problem-solving techniques, algorithms, and C programming concepts to solve computational problems.	Level-3 Apply
CO2	**Analyze** algorithms and C programs using control structures, functions, arrays, and debugging techniques.	Level-4 Analyze
CO3	**Evaluate** algorithms and C program solutions based on correctness, efficiency, and coding practices.	Level-5 Evaluate
CO4	**Develop** modular and efficient C programs using appropriate programming techniques to solve real-world problems.	Level-6 Create

List of Experiments:

EXP. No.	Experiments
1.	Develop an algorithm and draw a flowchart to find the largest of three numbers.
2.	Develop an algorithm, pseudo code, and flowchart to calculate the sum and average of N numbers.
3.	Write a C program to perform basic arithmetic operations using different operators.
4.	Write a C program to find whether a given year is a leap year using if-else statements.
5.	Write a C program to display the multiplication table of a given number using loops.
6.	Write a C program to generate the following patterns using nested loops: • Right triangle • Inverted triangle • Pyramid
7.	Write a C program to check whether a given number is Prime.
8.	Write a C program to check whether a given number is Palindrome.

9.	Write a C program to check whether a given number is an Armstrong number.
10.	Write a C program to find the factorial of a number and generate the Fibonacci series.
11.	Write a menu-driven C program using switch statement to perform: • Decimal to Binary conversion • Binary to Decimal conversion • Check Perfect Number
12.	Write a C program using user-defined functions to perform arithmetic operations (Addition, Subtraction, Multiplication, Division).
13.	Write a C program to perform searching on an array using Linear Search.
14.	Write a C program to sort an array using Bubble Sort.
15.	Write a C program to perform matrix addition and multiplication using two-dimensional arrays.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**MDE-101B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Knowledge Systems and Traditions**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	**The objectives of this course are:** • To understand the fundamental concepts of Indian Knowledge Systems, Indian culture, civilization, and ancient scientific traditions. • To understand the significance of traditional Indian creative practices, arts, architecture, music, dance, and craftsmanship. • To understand the relevance and application of Indian Knowledge Systems and creative practices in modern society and sustainable development.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**List** the concepts of Indian Knowledge System, Indian culture and civilization, ancient Indian sciences, architecture, and philosophical systems	Level-1Remember
CO2	**Explain** the principles and significance of Indian creative practices, traditional arts, crafts, music, dance, painting, and engineering techniques.	Level-2Understand
CO3	**Apply** traditional Indian knowledge and creative practices in activities related to art, design, performance, craftsmanship, and cultural expression.	Level-3Apply
CO4	**Analyze** the relevance and contributions of Indian Knowledge Systems and creative practices to modern society, culture, science, and sustainable living.	Level-3Apply

Note:

1. Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

2.Any eight of total sessions assigned for Literary activity from Unit-I and Unit-II.

3. Twenty Lectures with at least Five different topics of total session under Creative activity from Unit-III and Unit-IV.

Unit-I

Introduction to IKS: Indian Knowledge System, Indian Culture & Civilization, Ancient Indian Chemistry, Ancient Indian Metallurgy, Ancient Indian Mathematics, Ancient Indian Astronomy, Indian Astronomical Instruments.

Unit-II

Indian Knowledge System (Upveda: Ayurveda,Gandharveda)
Indian Knowledge System (Vedangas: Shiksha, Kalpa, Vyakrana, Jyotisha, Nirukta, Chandas)
Indian Architecture: I-Sthapatya-Veda, II: Temples, III: Town & Planning
Indian Philosophical System

Unit-III

Introduction to Creative Practices: Dhatuvada: art of metallurgy**,**Akara jnana: art of mineralogy**,** Vastuvidya: art of engineering**,**Yantramatrika: art of mechanics**,**Takshana: art of carpentry**,** Chalitakayoga: art of practicing as a builder of shrines**,**Raupyaratnapariksha: art of testing silver and jewels**,**Maniraga jnana: art of tinging jewels**,** Sucivayakarma: art of needleworks and weaving**,** Vadya vidya: art of playing on musical instruments**,** Geet vidya : art of singing**,** Nritya vidya: art of dancing

Unit-IV

Creative Practices: Natya vidya: art of theatricals**,** Alekhya vidya: art of painting**,** Viseshakacchedya vidya: art of painting the face and body with color**,** Udakavadya: art of playing on music in water**,** Manasi kavyakriya: art of composing verse**,** Bhushanayojana: art of applying or setting ornaments**,** Citrasakapupabhakshyavikarakriya: art of preparing varieties of delicious food**,** Dasanavasanangaraga: art of applying preparations for cleansing the teeth, cloths and painting the body**,** Utsadana: art of healing or cleaning a person with perfumes**,** Vastragopana: art of concealment of cloths**,** Balakakridanaka: art of using children's toys**,** Tandulakusumabalivikara: art of preparing offerings from rice and flowers**,** Pushpastarana: art of making a covering of flowers for a bed.

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru
- Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay,
  1995.
- The Cultural Heritage of India. Vol.I. Kolkata:Ramakrishna Mission Publication, 1972.
- Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
- Dr. R. C. Majumdar, H. C. Raychaudhuri and Kalikinkar Datta: An Advanced History of India (Second Edition) published by Macmillan & Co., Limited, London, 1953.
- Rao, N. 1970. The Four Values in Indian Philosophy and Culture. Mysore: University of Mysore.
- Avari, B. 2016. India: The Ancient Past: A History of the Indian Subcontinent from c. 7000 BCE to CE 1200. London: Routledge.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Indian Knowledge Systems	https://www.youtube.com/playlist?list=PLRfu94TCePTtVPR-kC4RpIGIwo7-ViCGP
Unit-II	Indian philosophy, Vedas, Vedangas, traditions, and IKS basics	https://www.youtube.com/watch?v=3H16y-XfMMc
Unit-III	Introduction to Creative Practices	https://www.anaadi.org/iksprimer?utm_source

Course Code	**MDE-103B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Mathematics and Astronomy**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	**The objectives of this course are:** • To understand the foundations of ancient Indian mathematics, astronomy, and numeral systems. • To understand the principles of Vedic mathematical methods, astronomical calculations, and ancient scientific texts. • To understand the significance of ancient Indian astronomical instruments, time systems, and scientific contributions.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	List the contributions of ancient Indian mathematicians, astronomers, numeral systems, and foundational concepts of Indian mathematics and astronomy.	Level-1Remember
CO2	Explain the principles of Vedic mathematics, Sulvasutras, algebraic methods, trigonometry, calendrical studies, and astronomical systems described in ancient Indian texts.	Level-2Understand
CO3	Apply ancient Indian mathematical and astronomical methods related to calculations, planetary motions, time systems, eclipses, and observational techniques.	Level-3Apply
CO4	Apply ancient Indian mathematical and astronomical methods related to calculations, planetary motions, time systems, eclipses, and observational techniques.	Level-3Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

The Introduction to Ancient Mathematics & Astronomy

Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods.Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta,bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, bharat muni, sripati,mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara).

Periodical enlisting of Mathematical & Astrological achievement in India.Evolution of Indian Numerals (Brahmi (1st century), Gupta (4th century) & Devanagri Script (11^{th}century)

Unit-II

Ancient Mathematics –I

Veda & Sulvasutras (Pythagoras theorem, Square root & Squaring Circle) (baudhayana sulbhasutra,apastamba sulbhasutra, katyayana sulbhasutra, manava sulbhasutra, maitrayana sulbhasutra, varahasulbhasutra, vadhula sulbhasutra , Pingala's chandasutras, sunya, yaat-tavat, Aryabhata (Aryabhatiya, Asanna, ardha-jya, kuttaka,),

bhaskara (trigonometory,shridhara, mahavira),Bhaskara Acharya (Sidhantashiromani), Varamahira panchasiddhantika.

Unit-III

Ancient Mathematics –II

Brahamgupta (vargaprakrati, bhramasphuta siddhanta, bhavana), ayatavrtta, ganitasarasamgraha,lilavathi, ganesadaivajna, randavantika, suryasidhhanta, grahalaghava, sadratnamala, mandavrtta,sighrartta, Bijaganita, Bakshali manuscriptGolavada, Madhyamanayanaprakara, Mahajyanayanaprakara (Method ofComputing Great Sines), Lagnaprakarana, Venvaroha, Sphutacandrapti, Aganita-grahacara ,Chandravakyani (Table of Moon-mnemonics)

Unit-IV

Ancient Astronomy –I

Parahita system of astronomy and drk system of astronomy, Manda samskara, sighra samskara.Vedanga Jyotisha (astronomical calculations, calendrical studies, and establishes rules for empiricalobservation), Aryabhatiya (earth rotation, shining of moon), Brahmasphutasiddhanta (motion ofplanets), varahmihira (pancasiddhantika), Mahabhaskariya, lahubhaskariya & arybhatiya bhashya(Planetary longitudes, heliacal rising and setting of the planets, conjunctions among the planets andstars, solar and lunar eclipses, and the phases of the Moon), Sisyadhiveddhida (grahadhyaya,goladhyaya), siddhantasiromani, karanakutuhala (planetary positions, conjunctions, eclipses,cosmography), siddhantasekhara, yantra-kirnavali, Sphuṭanirṇaya, Uparagakriyakrama.

Ancient Astronomy –II

Positional astronomy (sun, planets, moon, coordinate systems, precision of the equinox and itseffects, eclipses, comets and meteors), Mahayuga & Kalpa system Yuga system, ayanas, months,tithis and seasons, time units, sun and moon's motion, planet position, ayanachalana, zero-precisionyear, katapayaadi system, Indian nakshatra system, astronomy Instruments for naked eye astronomy (vedic observatories). The principal and application of SamratYantra, Jai Prakash Yantra, Disha Yantra, Rama Yantra, Chakra Yantra, Rashiwalya Yantra, DingashYantra, Utaansh Yantra

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
- R P Kulkarni, Glimpese of Indian Engineering and Technology (Ancient & Medieval period,Munshiram Manoharlal Publishers Pvt. Ltd. 2018
- AK Pathak, Science and Technology in India, Anshika prakashan pratapgarh, 2016
- NVP, Unithiri, Indian Scientific Traditions (Professor K.N. Neelakantan Elayath FelicitationVolume), publication division univeristy of Calicut, 2006
- Dharmpal, Indian science and technology in the eighteen century, rashtrottahana sahitya, 1983
- S Biswal, B L ray, vedic Science and technology, DK Print world, 2009
- A Kolachana, Studies in Indian Mathematics and Astronomy, Hindustan Book agency
- S B Rao, Indian Mathematics and Astronomy: Some Landmarks (Revised Third Edition), BhartiyaVidhya Bhavan, 2012,
- GG Josheph, Indian Mathematics: Engaging with the World from Ancient to Modern Times,speaking Tiger, 2016
- BS Yadav, Ancient Indian Leaps into Mathematics, brikausher publication, 2010
- DP Chatopadhya, Ravinder kumar, Mathematics, Astronomy, and Biology in Indian Tradition:Some Conceptual Preliminaries (Phispc Monograph Series on History of Philosophy, Science andCulture in India, No 3), Munshiram manohalal publication, 1995
- BV subbarayappa, The Tradition of Astronomy in India: History of Science, Philosophy and Culturein Indian Civilization Vol. IV, Part 4: Jyotihsastra (History of Science, Philosophy & Culture inIndian Civilization), centre for studies in civilization, 2008
- GE Clark, The Aryabhatiya of Aryabhata: An Ancient Indian Work on Mathematics and Astronomy,Kesinger publicaition, 2010
- Anonyms, Hindu Astronomy: Anuradha, Bharani, Hindu Chronology, Hindu Calendar, IndianAstronomy, Kerala School of Astronomy and Mathematics, Jyoti, Book LLC, 2011

- KV Sharma. Ganita yuktibhasa (Analytical Exposition of the Rationales of Indian Mathematics andAstronomy, Kindle, 2021
- R Mercier, Studies on the Transmission of Medieval Mathematical Astronomy (Variorum CollectedStudies), routledge publication, 2004.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Astronomy in Ancient, Medieval and Early Telescopic Era of India	https://www.youtube.com/watch?v=GZn8DtXVzkk
Unit-II	Arya bhata: A True Gem of Indian Mathematics and Astronomy	https://www.youtube.com/watch?v=LI6mzQvNRRs
Unit-III	Brahma sphuta siddhanta of Brahma gupta	https://www.youtube.com/watch?v=3bNFEJNY4Ds
Unit-IV	Pre Siddhantic Astronomy	https://www.youtube.com/watch?v=BURiuOGylS4

Course Code	**MDE-105B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Vision for Human Society**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	**The objectives of this course are:** • To help the learner to understand the concept of "Vasudhaiva Kutumbkam" and its realization process as a base for the development of vision for a humane society. • To help to identify the universality in humans and its coexistence in existence. • To introduce the sense of responsibility, duties, and participation of individuals for establishment of a fearless society. • To understand the apparently rational, verifiable, and universal solution from the ancient Indian knowledge system for the holistic development of physical, mental, and spiritual wellbeing of one and all, at the level of individual, society, nation, and ultimately the whole world.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Remember** core concepts related to human existence, consciousness, and social harmony.	Level-1Remember
CO2	**Understand** the aims of human life and the ethical foundations of individual and societal well-being	Level-2Understand
CO3	**Apply** philosophical and ethical principles to personal conduct and social interactions.	Level-3Apply
CO4	**Apply** integrated knowledge to promote harmony, balance, and purposeful living in society.	Level-3Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

The world view & Vision of Human Society:- The concept of non-duality of Prakriti (Jad) and Purush (Chetana), human as coexistence of Jad & Chetan, Pancha-mahabhutas, the root of sorrow and suffering, freedom from sorrow, salvation, eternal peace truth (Vyaharika Satya), ultimate truth. The acceptance of various systems of philosophy for realization of truth and complementariness in society in ancient Indian system.

Unit-II

Aspiration and Purpose of Individual and Human Society: - Aims of Human life; at individual level and societal level. At societal level; Four Purusarthas Dharma, Artha, Kama, Moksha. Individual level; Abhyudaya (progress), Nihsreyasa (perfection) Pravrtti, Nivrtti. Dharma; Dharma

sutras (Gautama, apastamba, baudhayana, vasistha). Dharma-Shastra; (manusmriti, naradamrti,visnusmrti, yajnavalkya smriti) sociology, different stages of life like studenthood, householdership, retirement and renunciation, rites and duties, judicial matters, and personal laws (Aachara, Vyavahara, Prayaschitta). Artha; Kautliya Arthashastra, Kamandakiya Nitisara, Brihaspati Sutra, Sukra Niti, Moksha: Human liberation (Ignorance to Knowledge).

Unit-III

Program for Ensuring Human Purpose: at Individual and Societal level :- Fundamental concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul). The true constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamay Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana). Differentiating Vidya and Avidya, human bondages, Higher and Lower Knowledge (Para Vidhya & Apara Vidhya). Concept of Sattva, Rajas, Tamas and need of balancing the same, Patanjali yog sutra; Yama, Niyama, Asanas, pranayams, pratyahara, dharna, dhyana, Samadhi, Sixteen category of padartha, pramans (pratyaksh, anuman, upaman, shabda). Saadhana chatushtayam (viveka, vairagya, mumukshatavam, shadsampathi (sama, dama, uparama, titiksha, shradha, samadhana), Understanding Nitya karma, Naimittika Karma, Kamya karma, prayaschitta karma, Nishidha Karma. Meditation and Progressive meditation (Narada's education), Ativadin to self-knowledge, Jyan yog, Karma yog, sanyas yog in the aspect of harmonious practice in society.

Unit-IV

Practices for Ensuring Human Purpose – III: Practice in philosophy, architecture, grammar, mathematics, astronomy, metrics, sociology, economy and polity, ethics, geography, logic, military science, weaponry, agriculture, mining, trade and commerce, metallurgy, shipbuilding, medicine, poetics, biology, and veterinary science.

Suggested Readings:

- Textbook on IKS by Prof. B. Mahadevan, IIM Bengaluru.
- Maharaj Swami Chidatmanjee, *Ancient Indian Society*, Anmol Publication Pvt. Ltd., India.
- S. C. Manerjee, *Society in Ancient India: Evolution since the Vedic Times Based on Sanskrit, Pali,Prakrit and Other Classical Sources: No. 1 (Reconstructing Indian History and Culture)*, DK Printing, India.
- Rao, N. (1970). *The Four Values in Indian Philosophy and Culture*. Mysore: University of Mysore.
- Chakraborti, K. (2001). *Religious Process: The Puranas and the Making of Regional Tradition*. Delhi: OUP.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Indian Philosophy	https://www.youtube.com/watch?v=ddJg3gzYEb8
Unit-II	Indian Philosophy(Orthodox & Heterodox Systems)	https://www.nptelprep.in/courses/109106059/videos
Unit-III	Indian Knowledge Systems	https://www.youtube.com/playlist?list=PLRfu94TCePTtVPR-kC4RpIGIwo7-ViCGP
Unit-IV	Philosophy & Consciousness (Sankhya/Yoga Focus)	https://archive.nptel.ac.in/courses/109/106/109106059/

Course Code	**MDE-107B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Culture and Civilization**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	**The objectives of this course are:** • To introduce the fundamentals of Ancient Indian Education to understand the pattern and purpose of studying Vedas, Vedangas, Upangas, Upaveda, Purana&Itihasa. • To help students to trace, identify, and develop the ancient knowledge systems. • To help to understand the apparently rational, verifiable, and universal solution from the ancient Indian knowledge system for the holistic development of physical, mental, and spiritual wellbeing. • To build in the learners a deep-rooted pride in Indian knowledge, committed to universal human rights, well-being, and sustainable development.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Remember** core ideas and texts of Indian knowledge traditions.	Level-1 Remember
CO2	**Understand** philosophical and scientific foundations of knowledge systems.	Level-2 Understand
CO3	**Apply** traditional concepts to interpret science, language, and culture.	Level-3 Apply
CO4	**Apply** integrated knowledge to real-life and managerial contexts.	Level-3 Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to IKS: CaturdaśaVidyāsthānam, 64 Kalas, ShilpaŚāstra, Four Vedas, Vedāṅga,Indian Philosophical Systems, Vedic Schools of Philosophy (Sāṃkhya and Yoga,Nyaya and Vaiśeṣika, Pūrva-Mīmāṃsā and Vedānta), Non-Vedic schools of Philosophical Systems (Cārvāka, Buddhist, Jain), Puranas (Maha-puranas,Upa-Puranas and Sthala-Puranas), Itihasa (Ramayana, Mahabharata), NitiSastras, Subhasitas

Unit-II

Foundation concept for Science & Technology: Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (BhūtaSaṃkhya System, Kaṭapayādi

System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa,Saṃśaya**.**

Unit-III

Indian Mathematics & Astronomy in IKS: Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of Trigonometry, Algebra, Chandah Sastra of Pingala,Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System Astronomical Instruments (Yantras) JantarMantar or Raja Jai Singh Sawal.

Unit-IV

Indian Science & Technology in IKS: Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas) Metals and Metalworking technology (Copper, Gold, Zinc, Mercury, Lead and Silver), Iron & Steel, Dyes and Painting Technology), Town & Planning Architecture in India, Temple Architecture, Vastu Sastra,

Humanities & Social Sciences in IKS: Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water inwellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-Intellect- Consciousness Complex. Governance, Public Administration & Management reference to Ramayana, Artha Sastra, Kauṭilyan State

Suggested Readings:

- Textbook on IKS by Prof. B. Mahadevan, IIM Bengaluru.
- Kapur, K. and Singh, A. K. (Eds.) (2005). *Indian Knowledge Systems*, Vol. 1. Indian Institute of Advanced Study, Shimla. *Tatvabodh* of Shankaracharya, Central Chinmaya Mission Trust, Bombay, 1995.
- Nair, Shantha N. *Echoes of Ancient Indian Wisdom*. New Delhi: Hindology Books, 2008.
- S. K. Das, *The Education System of Ancient Hindus*,Gyan Publication House, India.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Indian Knowledge Systems (Philosophy & Culture)	https://www.youtube.com/watch?v=5f0phlOdYvU
Unit-II	Ayurveda & Traditional Medicine in Indian Knowledge Systems	https://www.youtube.com/watch?v=xORzinU4oC8
Unit-III	Indian Contributions to Mathematics (Ancient Mathematics & Systems)	https://www.youtube.com/watch?v=T0gCkyKVQUg
Unit-IV	Indian Astronomy & Calendar Systems	https://www.youtube.com/watch?v=JpZBaHsQ2Ws

Course Code	**MDE-109B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Science, Engineering and Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are • To familiarize learners with major sequential development in Indian science, engineering and technology. • To review & strengthen the ancient discovery and research in physics, chemistry, maths, metallurgy, astronomy, architecture, textile, transport, agriculture and Ayurveda etc. • To help students to trace, identify and develop the ancient knowledge systems to make meaningful contribution to development of science today.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** key ideas, historical contributions of traditional knowledge systems.	Level-1 Remember
CO2	**Understand** the principles, cultural knowledge creation and practice.	Level-2 Understand
CO3	**Apply** traditional scientific concepts to explain natural phenomena, health, and technology.	Level-3 Apply
CO4	**Apply** integrated knowledge to relate traditional practices with contemporary life and sustainability.	Level-3 Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Indian Traditional Knowledge; Science and Practices: Introduction to the Science and way of doing science and research in India, Ancient Science in Intra & Inter Culture Dialogue & coevolution. Traditional agricultural practices, Traditional water-harvesting practices, Traditional Livestock and veterinary Sciences Traditional Houses & villages, Traditional Forecasting, Traditional Ayurveda & plant-based medicine, Traditional writing Technology

Unit-II

Ancient Indian Science (Physics, Chemistry, Maths): Physics in India: Vaisheshika Darshan atomic theory & law of motion, theory of Panchmahabhoota, BrihathShathaka (divisions of time, unit of distance), Bhaskaracharya (theory of gravity, Surya Siddhanta&Siddhanta Shiromani), Lilavati (Gurutvakarshan Shakti).

Chemistry in India: Vatsyayana, Nagarjuna, Khanda, Al-Biruni, Vagbhaṭa – building of the Ras-shala (laboratory), working arrangements of Ras-shala, material and equipment, YaśodharaBhaṭṭa – process of distillation, apparatus, saranasamskara, saranataila.
Mathematics in India: Baudhayana'sSulbasutras, Aryabhaṭa, Bhaskaracharya-I, Severus Sebokht, Syria, Brahmagupta, Bhaskaracharya-II, Jyeṣṭhadeva.

Unit-III

Ancient Indian Science (Metallurgy, Astronomy, Architecture): Metallurgy in India: Suvarna (gold) and its different types, properties; Rajata (silver); Tamra (copper); Loha (iron); Vanga (tin); Naga / Sisa (lead); Pittala (brass).
Astronomy in India: VedangaJyotish; Aryabhata Siddhanta; Mahabhaskriya; Laghubhaskriya; VatesvaraSiddhanta; Sisyadhivrddhida; Grahashraya; Goladhyaya; Karana Kutuhala (Aryabhaṭa, Varahamihira, Brahmagupta, Vatesvara, Bhaskara, Paramesvara, NilakanthaSomayaji, Jyeshthadeva, Shankara Varman).
Architecture in India: Nagara (northern style), Vesara (mixed style), and Dravida (southern style); Indian vernacular architecture; temple style; cave architecture; rock-cut architecture; Kalinga architecture; Chandela architecture; Rajput architecture; Jain architecture; Sikh architecture; Maratha architecture; Indo-Islamic architecture; Indo-Saracenic revival architecture; Greco-Buddhist style.

Unit-IV

Ancient Indian Science (Textile, Agriculture, Transport): Textile Technology in India: Cotton (natural cellulose fiber), silk, wool (natural protein fibers), bast and leaf fibres; mridhudhautadhupaitambaram (meaning a practice of fumigating the fabric with incense smoke before use as a part of the finishing process); Sitadhautavasanayugala (bleached white – a finishing process); suchhastah, sutradharah (needle and thread – tools for stitching); dyeing, washing, spinning, and weaving technology.
Agriculture in India: KrishiSuktas, Krishiparashara, Brihatsamhita; types of crops; manures; types of land – devamatruka, nadimatruka; use of animals in warfare; animal husbandry; animals for medicines.
Ancient Transport in India
Ancient Indian Science (Ayurveda & Yoga):Ayurveda for Life, Health, and Well-being: Introduction to Ayurveda; understanding the human body and PanchaMahaBhuta; the communication between body & mind; health regimen for well-being; introduction to Yoga (Raja Yoga, Ashtanga Yoga, Jnana Yoga); understanding of Indian psychological concepts; consciousness; Tridosha&Triguna.

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
- Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatva Bodh of Shankaracharya, Central Chinmay mission trust, Bombay, 1995.
- Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
- SK Das, The education system of Ancient Hindus, Gyan publication house, India
- Dharmpal, Indian science and technology in the eighteen century, rashtrottahanasahitya, 1983

Useful VideoLinks:

Unit No	Topics	Links
Unit-I	Indian Traditional Knowledge & Research Culture	https://archive.nptel.ac.in/courses/121/106/121106003/
Unit-II	Ancient Indian Science (Physics, Chemistry, Maths)	https://www.youtube.com/watch?v=T0gCkyKVQUg
Unit-III	Ancient Indian Science (Metallurgy, Astronomy, Architecture)	https://www.youtube.com/watch?v=r5KTrbJlKAA

Course Code	**MDE-111B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Town Planning and Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are • To develop the knowledge and analysis on the understanding of eco-friendly, robust and scientific planning and architecture system of ancient India. • To understand the importance of functional, aesthetic, psychological, culture and socio religious concept of ancient India architecture. • To help the learners to trace, identify and develop the approach, process and material used in town and planning, construction and architecture. • To understand the various eco-friendly technology accepted in ancient civilization				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** the concepts related to human settlements and architectural traditions.	Level-1Remember
CO2	**Understand** how culture, environment, and human needs influence-built forms.	Level-2Understand
CO3	**Apply** principles of form, space, materials in architectural examples.	Level-3Apply
CO4	**Apply** analytical understanding to compare regional and period-based architectural practices.	Level-3Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

The Introduction to ancient Architecture: Introduction to relationship between Man, Nature, Culture and city forms. Study of determinants (Natural and man-made) influencing location, growth &pattern of human settlements including types of settlements growth (Organic and planned) and settlement forms. Architecture as satisfying human needs: functional, aesthetic and psychologicaloutline of components and aspects of architectural form-site, structure, skin, materials, services, use, circulation, expression, character, experience. Understanding of the causative forces - the cultures, history, socio religious practices and institution, political and economic conditions, issues of land, climate and technology, Historical and Primitive Architecture.

Unit-II

Ancient Architecture as Expression of Art & Design: Relationship between Art and Design with man, space and environment. Expression in Art and Architecture – concept of space, sense of enclosure openness,robustness, dynamism, spatial geometry, Eco-friendliness. Architecture through use of elements of visual arts such as point, line, plane, form, space, colour, texture, light, solids and voids,

shadow and shade etc. Understanding of effect of scale, proportions, order, material effects such as textures, patterns, light, sound, temperature etc. in architectural spaces.
Allied visual and performing arts and its relationship to build environments using colour theory, symbolism, glass painting, scriptural writing, clay moulding, and stone carving. Important Indian architecture as per elements space & form: specific geometry form (sphere, cube, pyramid, cylinder and cone and its sections as well as their derivatives) Space: build form space, open space, Internal and External space, Continuous spaces Centralized, Linear, Radial Clustered, Grid space Different type of Materials used for construction in Ancient Indian architecture. Clay products: Classification of bricks, Fire Brick, Fly Ash Bricks, Tiles, Terracotta, Earthenware, Porcelain, Stoneware. Stones: Uses of Stones, Qualities of Good Building Stones, Dressing, Common Building Stones of India. Glass: Different glass Forms and their Suitability, Timber: Different Forms and their Suitability Metals: Ferrous & Nonferrous Metals and Alloys, and, their Suitability, limitations, precautions Paints and Varnishes: Different types and their Suitability, limitations, precautions

Unit-III

Ancient Architecture Principle & Planning: Design: Principles of designing – Composition of Plan. Inception and development of the early Hindu temple form with reference to Vedic and
Buddhist planning principles and design elements; Development of regional styles and manifestations thereof; Evolution of temple complexes and temple towns; planning: Residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors. Vastushastra and its importance in building interrelationship with human, nature and cosmos Town Planning: Town plans of Harappa, Mohenjo-Daro, Pataliputra, and Delhi. Vastushastra and its application in city layout.

Unit-IV

Ancient Architecture-I: The settlement planning pattern, elements, associated forms, typical Vedic village, towns (Dandaka, Nandyavartha etc.), typology of Shelters and civic buildings of ancient architecture in reference to following civilization: Indus Valley, Aryan/Vedic Civilisation, Buddhist Architecture, Indo Aryan & Dravidian Architecture. Role of Shilpasastras and Arthashastra in settlement planning. Important architecture: Great baths, Development of fortification, walled towns, structures developed e.g.: Stupas, Viharas, Chaityas, Stambhas, Torana, sacredrailingetc. Study of worshipping places with especial reference to Indo Aryan / Nagarastyle & Dravidian style (Chola, Chalukya, Pallava, Satavahana, Hoysala,Vijayanagar etc.), design of shikharas&gopuram, rock-cut and structural examples of temples.
Ancient Architecture-II: Evolution of Hindu Temples in different period: Gupta, Aihole, Badami,Pattadakkal, Mahabalipuram, Indo Aryan Style in Orrisa, Khajuraho, Gujarah,Rajasthan. Dravidian Style in Chola, Chalukyan, Pandya, Pallava, HoysalaStyle, Revival of Hindu architecture of South India at Vijaynagara and Madurai Tradition Indian villages & House: Regional house construction, interior &importance e.g. Rajasthani house, bhungas of Kutch, nalukettu of Kerala, Ikraofassam, manduvalogili or illu of Andra Pradesh, Wadas of Maharashtra, Mudhouses of Madhya Pradesh, kathkuni of Himachal Pradesh, khanjagharaoforisha, Taq and dhajjidiwari of Kashmir etc.Scientific achievements though ancient architect: JantarMantar, MusicalPillars of Vitthal temple, Sundial of Konark temple, construction of eight shivatemple in straight line from Kedarnath to Rameshwaram at longitude 79oE41’54, Veerbhadra temple with 70 hanging pillars, Ellora caves excavating the mountain, Jaipur plan pink city etc.

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
- Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatva Bodh of Shankaracharya, Central Chinmay mission trust, Bombay, 1995.
- Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
- Dr. V. Ganapati Sthapati, Building Architecture of Sthapatya Veda
- BinodeBehariDutt, Town planning in ancient India, Life Span Publishers & Distributors
- NR Dave, A Study of The Hindu Science of Architecture and its Practice with Special Reference to Raja Vallabha, Bharti Vaidya Bhavan, 2011
- M W Meister, South India Lower DravidaDesa - Encyclopaedia of Indian Temple Architecture (Set of 2 Books)- An Old and Rare Books, American Institute of Indian Studies, 1999
- D N Shukla Civil Architecture in Ancient India (Part-I) Meharchand Lakshmi Das publication, 2016.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Early Architecture & Human Settlements	https://www.youtube.com/watch?v=zq8t_XnJhTQ
Unit-II	Buddhist, Early Temple & Built Forms	https://www.youtube.com/watch?v=zq8t_XnJhTQ
Unit-III	Temple Evolution & Material/Spatial Concepts	https://www.youtube.com/watch?v=7Bx9UYSIIDk
Unit-IV	Historical Examples & Site Planning	https://www.nptelprep.in/courses/124106009/videos?

Course Code	**MDE-113B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Health, Wellness and Psychology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are • To Understand the fundamental principles of Indian health systems such as Ayurveda and yoga which are useful in maintaining the health of a healthy person. • Understand traditional way of cleansing the body regularly, strengthening body with Yogic exercises, maintaining the internal balance to prevent diseases • To understand our unique Mind Body Constitution and choosing the right lifestyle suitable to maintain the internal balance. • Understanding mind and its dynamics through knowledge of Ayurveda and Yoga and using the knowledge to maintain harmony between body and mind to achieve perfect mental health.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall fundamental concepts related to human constitution, health maintenance, and mind–body interrelationships.	Level-1Remember
CO2	Explain how internal balance, lifestyle practices, and mental factors influence overall wellbeing and immunity.	Level-2 Understand
CO3	Apply principles of daily and seasonal routines, diet, and self-care practices to promote physical and mental health	Level-3 Apply
CO4	Apply integrative mind–body principles to enhance resilience, self-awareness, and holistic health in everyday life.	Level-3 Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Understanding human body: Introduction to Ayurveda, the Knowledge of Life, Health and treatment aspectsin Ayurveda, Influence of Panchamaha Bhuta on Internal environment of Human being, understanding composition of Human body through the concept of Dosha Dhatu Mala, Understanding Prakruthi, the Mind – Body Constitution.

Unit-II

Understanding the communication between body & Mind: Establishing communication between body and mind by understanding the language of body. Understanding the concept of Agni, Koshta, Sara and Ojas and their relevance in enhancing our immunity to protect from various infections. Looking at the world through the lenses of Dravya, Guna and Karma Applying the principle of Samanya and Visesha in every aspect of life to achieve perfect health.

Unit-III

Introduction to Health Regimen: Understanding Swasthavritta, the healthy regimen to maintain state of wellbeing Dinacharya, the Daily regimen including Daily detoxification, exercise, Intake of Food, Water, Air and Sunlight, work and ergonomics, Rest and sleep hygiene. Ritucharya, the seasonal regimen, Sadvritta and the concept of social wellbeing, understanding trividhaupastambhas, three pillars to health, Concept of Shadrasa in choosing appropriate nourishment to the body and mind.

Unit-IV

Introduction to Yoga: Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. Brief Introduction of Hatha yoga, Raja yoga, Karma yoga, Gyana Yoga, Bhaktiyoga Understanding eight steps of Ashtanga yoga, Understanding Shatkriyas, the six cleansing procedures of Yoga
Introduction to Indian Psychology: Concept of Manas in Ayurveda and understanding Mind Body harmony, Triguna based Psychology in Ayurveda and Yoga, Influence of Tri dosha on Mind, Mind body intellect and consciousness complex, Understanding Consciousness and solution to issues within Human Mind.

Suggested Readings:

- Dr Deepak Chopra, Perfect Health--Revised and Updated: The Complete Mind Body Guide, Harmony publication, 2001
- Vasant lad, Ayurveda, the Science of Self-healing: A Practical Guide: Science of Self- healing, lotus press, 1984
- BKS Iyengar, Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority, thronson publication, 2006
- SwamySatyanandaSaraswati, Asana, Pranayama, Mudra and Bandha, Bihar School of Yoga, 2002

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introductory Concepts & Roots of the Tradition	https://www.youtube.com/watch?reload=9&v=16-q-V9lG5w&embeds_referring_euri=https%3A%2F%m%2F
Unit-II	Human Body, Constitution & Balance	https://www.youtube.com/watch?v=ty9ZfluxOFk&embeds_referring_euri
Unit-III	Healthy Living & Well-Being (Daily/Seasonal Regimen)	https://www.youtube.com/watch?v=9AJseqmcrfQ

Course Code	**AEC-BCA-101B**				
Category	Ability Enhancement Course				
Course Title	**General English**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To provide learning environment to practice listening, speaking, reading and writing skills. 2. To assist the students to carry on the tasks and activities through guided instructions and materials. 3. To effectively integrate English language learning with employability skills and training. 4. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** fundamental concepts of vocabulary, grammar, and language structures used in effective communication.	Level-1Remember
CO2	**Explain** principles of writing and speaking skills, including sentence construction, paragraph development, and oral communication techniques.	Level-2Understand
CO3	**Apply** writing and oral communication skills to construct correct sentences, develop coherent paragraphs, and communicate effectively in written form.	Level-3Apply
CO4	**Apply** oral and written communication techniques to improve clarity, accuracy, and effectiveness in academic and professional situations.	Level-3Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Vocabulary Building: -The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

UNIT – II

Basic Writing Skills: - Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.

UNIT – III

Identifying Common Errors in Writing and Nature and Style of Sensible Writing: - Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies.

Sensible Writing: - Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Writing Practices, Comprehension, Precise Writing and Essay Writing.

UNIT – IV

Oral Communication: - Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at the Workplace, Interviews, and Formal Presentations.

Reference Books

- Effective Communication Skills, Kul Bhushan Kumar, Khanna Book Publishing,
- Practical English Usage, Michael Swan. OUP.
- Remedial English Grammar, F.T. Wood. Macmillan.
- On Writing Well, William Zinsser. Harper Resource Book.
- Study Writing, Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.
- Communication Skills, Sanjay Kumar and PushpLata, Oxford University Press.
- Exercises in Spoken English, Parts. I-III, CIEFL, Hyderabad, Oxford University Press.
- English Phonetics for Indian Students by T Balasubramanian, Triunity Press, Bengaluru
- English Grammar in Use by Murphy, Raymond, Cambridge University Press, Cambridge

Video Links

Unit No	Topics	Links
Unit-I	Synonyms	https://youtu.be/mgLlPJkxmFU?si=UJpRjVm3tZi8iYm6
Unit-II	Techniques for writing precisely	https://nptel.ac.in/courses/109107172
Unit-III	Subject-verb agreement	https://nptel.ac.in/courses/109106116
Unit-IV	Communication at Workplace	http://digimat.in/nptel/courses/video/109107394/L12.html

Course Code	**VAC-BCA-101B**				
Category	Value Added Courses				
Course Title	**Environmental Science and Sustainability**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To familiarize students with basic environmental concepts, their relevance to business operations and forthcoming sustainability challenges. 2. To equip students to make decisions that considers environmental consequences. 3. To enable future business graduates to become environmentally sensitive and responsible managers.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the fundamental concepts of environment, sustainability, natural resources, ecosystems, biodiversity, pollution, and environmental legislation.	Level-1Remember
CO2	**Describe** environmental challenges, ecosystem dynamics, biodiversity conservation, pollution control measures, waste management practices, and sustainable development initiatives.	Level-2Understand
CO3	**Apply** sustainable practices, resource conservation methods, pollution control measures, disaster management approaches, and environmental ethics in business and societal contexts.	Level-3Apply
CO4	**Apply** environmental laws, sustainability principles, and responsible business practices to address environmental and social issues for sustainable development.	Level-3Apply

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Understanding Environment, Natural Resources and Sustainability

Fundamental environmental concepts and their relevance to business operations; Components and segments of the environment, the man-environment relationship, and historical environmental movements. Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation. Sustainable practices in managing resources, including deforestation, water conservation, energy security, and food security issues. The conservation and equitable use of resources, considering both intergenerational and intergenerational equity, and the importance of public awareness and education.

UNIT – II

Ecosystems, Biodiversity, and Sustainable Practices

Various natural ecosystems, learning about their structure, functions, and ecological characteristics. The importance of biodiversity, the threats it faces, and the methods used for its conservation. Ecosystem resilience, homeostasis, and carrying capacity, emphasizing the need for sustainable ecosystem management. Strategies for in situ and ex situ conservation, nature reserves, and the significance of India as a mega diverse nation.

UNIT – III

Environmental Pollution, Waste Management, and Sustainable Development

Various types of environmental pollution, including air, water, noise, soil, and marine pollution, and their impacts on businesses and communities. Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management; Natural and man-made disasters, their management, and the role of businesses in mitigating disaster impacts.

UNIT – IV

Social Issues, Legislation, and Practical Applications

Dynamic interactions between society and the environment, with a focus on sustainable development and environmental ethics. Role of businesses in achieving sustainable development goals and promoting responsible consumption. Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Environmental justice, environmental refugees, and the resettlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India.

Reference Books

- Environmental Studies, Poonia, M.P., Khanna Book Publishing Co.
- Textbook of Environmental Studies, Bharucha, E., Orient Blackswan Private Ltd.
- Text Book of Environmental Studies, Dave, D., & Katewa, S. S., Cengage Learning India Pvt Ltd.
- Environmental studies: from crisis to cure, Rajagopalan, R., Oxford University Press.
- Living in the Environment, Miller, G.T. & Spoolman S., Cengage Learning India Pvt Ltd.
- Fundamentals of environmental studies, Basu, M., & Xavier Savarimuthu, S. J., Cambridge University Press.
- Sustainable Development: Environment, Energy and Water Resources, Roy, M. G., Ane Books.
- Environmental Studies by BB Chawdhary, CL Chaturvedi, Mahavir Publication Company, New Delhi

Useful Video Links:

Unit No	Topics	Links
Unit-I	Natural Resource Management	https://nptel.ac.in/courses/126103022
Unit-II	Ecosystem and it's Components	https://nptel.ac.in/courses/105105826
Unit-III	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Principles of Sustainable Development	https://nptel.ac.in/courses/109105203

Course code	**AEC-BCA-103B**				
Category	**Additional Course**				
Course title	**French**				
Scheme and Credits	L	T	P	**Credits**	Semester-I
	1	1	0	-	
Course Objectives:	The objectives of this course are • To understand foundational language skills necessary for basic communication, including introducing themselves and others, describing places, and talking about their surroundings. • To focus on enhancing students' ability to express personal likes, interests, and other simple ideas, ensuring their ability to engage in basic communicative transactions. • To achieve a partial A1 level by the end of the semester according to the Common European Framework, which will enable them to handle simple communication in everyday situations.				
Assessment	50 Marks				
End Semester Examination	-				
Total	50 Marks				
Remarks	An '**Additional Course'** is a non-credit Ability-Enhancement Course that is undertaken for learning purposes only. If completed, the '**Additional Course'** may be recorded. The **Additional Course (Ability Enhancement Course)** is included as a qualifying paper and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.				

Course Outcomes: After studying this course, the students will be able to:

CO	Skill Demonstrated	Level
CO1	**Define** key concepts related to reading, listening, speaking, and writing in English, focusing on everyday communication.	Level-1 Remember
CO2	**Explain** basic communication techniques for understanding texts, listening to simple conversations and expressing oneself in writing.	Level-2 Understand
CO3	**Apply** reading skills to use simple texts (e.g., notices, short passages, emails) and extract relevant information to answer questions or complete given tasks.	Level-3 Apply
CO4	**Apply** listening skills to understand simple conversations or audio messages and respond appropriately by completing activities such as answering questions or writing brief personal messages.	Level-3 Apply

Unit-I

Reading: Reading Simple Texts Related to One's Immediate Environment such as Notices, Posters, Catalogs, Fliers, Personal Messages or Emails and Answering Questions on them.

Unit-II

Listening: Understanding familiar Words and very Basic Phrases about Oneself, One's Family, and Immediate Concrete Surroundings, such as Very Brief Announcements in Public Spaces, Short, Simple Formal/Informal Conversation, Questions and Instructions When Speakers are Speaking at a Slower Pace.

Unit-III

Writing: Guided Writing will Include activities such as, Filling a Form, Writing Simple Phrases (Postcards, Messages, Invitations etc) on everyday Topics.

Unit-IV

Monologue: Describing and Presenting oneself, One's Immediate Environment and the People S/He Knows Using Simple Phrases and Sentences.

Dialogue: Taking part in a Conversation and Interaction in a Simple way provided the other Person is Prepared to Repeat or to Rephrase more Slowly and help Formulate what S/he is trying to say asking simple Questions on familiar Topics or Matters related to one's Immediate Environment. Making simple Purchases in Shops or Obtaining Services that one Requires.

Suggested Readings:

- Mon Posseport by Preeti Bhutani, Unisec Publication,Delhi
- Kizirian, V. M, Daill, E., Berthet, A., Hugot, C., Waendendries, M. Alter Ego + 1. Paris: Hachette.
- Berthet, A., Daill, E., Hugot, C., Waendendries, M. Alter Ego+ 1, Cahier d'activités. Paris: Hachette.
- Hachette, Y., Mérieux, R. Latitudes 1, (Livre de l'élève & Cahier d'exercices). Paris: Didier.
- Cocton, M-N., Dupleix, D., Heu, E., Kasazian, E., Ripaud, D.Saison 1, (Livre de l'élève & Cahier d'exercices). Paris: Didier.
- Denyer, M., Garmendia, A., Lions-Olivieri, M-L. Version Originale 1, Livre de l'élève. Paris: Editions Maisons des Langues.
- Magne, M., Lions-Olivieri, M-L. Version Originale 1, Cahier d'exercices. Paris: Editions Maisons des Langues.

Useful Video Links:

Unit No	Topics	Links
Unit-I	French Absolute Beginners Guide	https://www.youtube.com/watch?v=Sk6YQynZ1h8
Unit-II	French Listening Practice - 50 Everyday French Sentences	https://www.youtube.com/watch?v=Aofb0XEJIks
Unit-III	Learn how to write French with me	https://www.youtube.com/watch?v=9iUiei9YMCk
Unit-IV	Slow and Easy French Conversation Practice	https://www.youtube.com/watch?v=ReVCwcHwnZI

Course Code	**CC-BCA-102B**				
Category	Core Courses				
Course Title	**Mathematics Foundation to Computer Science-II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • Provide mathematical foundations including algebraic structures, numerical methods, and optimization for solving computational problems. • Enhance problem-solving abilities to address theoretical and practical challenges in computer science applications.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Describe** fundamental concepts, definitions, formulas, and methods related to logic, algebraic structures, numerical methods and optimization techniques.	Level 1:Remember
CO2	**Explain** logical reasoning, algebraic systems, numerical computation methods and linear programming concepts for solving mathematical problem.	Level 2: Understand
CO3	**Solve** mathematical and computational problems using proof techniques, algebraic operations, numerical methods and optimization techniques.	Level 3: Apply
CO4	**Analyze** logical statements, algebraic structures, numerical solutions and optimization models for real world problems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Logic and Methods of Proofs: Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF).Methods of proofs: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction.

UNIT –II

Algebraic Structures: Semi-group, Monoid, Group, Subgroup, Cyclic group.

UNIT- III

Numerical Methods : Concept and importance of errors in numerical methods. Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson methods.

Numerical Interpolation: Newton's Forward and Newton's backward interpolation formula and Lagrange's formula.

Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule only formula and problem solving for all the topics mentioned above.

UNIT- IV

Optimization Techniques: Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Special cases in graphical methods, Simplex method, Duality.

Transportation problem: Definition, Linear form, North-west corner method, Least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution.

Suggested Readings:

- Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
- Sastry S.S., Introductory Methods of Numerical Analysis, Fifth Edition, PHL, 2022.
- TahaHamdy A., Operations Research: An Introduction, Eighth Edition, Pearson Prentice Hall, 2003.
- S.B. Singh, Discrete Structures, Khanna Book Publishing,2023(AICTE Recommended Textbook)
- Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
- Chakravorty J.G. and Ghosh P.R., Linear Programming and Game Theory, Moulik Library, 2017.
- Sharma J.K., Operations Research: Theory and Applications, Fourth Edition, Macmilllan Publishers, 2007.

Useful Video Links:

Unit No.	Topics	Links
UNIT-1	Propositions, logical operations (basic connectives), compound statements	https://www.youtube.com/watch?v=r8G6dxvBDmg
	tautology, contradiction, contingency,	https://www.youtube.com/watch?v=FPXjypbgFUA
	Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF)	https://www.youtube.com/watch?v=w2DlMu8ZzHE
	Methods of proofs: Rules of inference for propositional logic, modus ponens, modus tollens	https://www.youtube.com/watch?v=0_URFaZQXUU

	Mathematical Induction.	https://www.youtube.com/watch?v=7WUPTe39fMg
UNIT-1I	Semi-group, Monoid, Group	https://www.youtube.com/watch?v=ihQyZ7bJcRE
	Subgroup, Cyclic group.	https://www.youtube.com/watch?v=wx676fYedZ0
UNIT-1II	Newton's Forward and Newton's Backward interpolation formula	https://youtu.be/Aw6LvaPtESE?si=uMd0moKsGOB4ocTu
	Lagrange's formula.	https://youtu.be/W89qBdRI8e4?si=y-zOk1zmJGppPWZp
	Trapezoidal rule and Simpson's 1/3 rule.	https://youtu.be/EA76ONWBgK4?si=SpIE1WNaO8e0gpnp
UNIT-1V	Graphical method for solving LPs with two variables, Simplex method, Duality	https://youtu.be/2EvC1v1FI2k?si=8d1deI63m8vJeB_M
	Linear form, method for finding feasible solution, MODI method for finding optimum solution.	https://youtu.be/Ow3XWYnPgSM?si=E01KqUcTKzr6w1fy https://youtu.be/NqXFWCHIbII?si=z-qfuKLGVg1AUXBi

Course Code	**CC-BCA-104B**				
Category	Core Courses				
Course Title	**Data Structures**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	3	0	0	**3**	
Course Objectives	• Understand the fundamental concepts of Data Structures and their applications. • Develop problem-solving skills using Data Structures. • Implement Data Structures using C programming language.				
Assessment	25Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, classifications, representations, operations, and applications of arrays, linked lists, stacks, queues, hashing, trees, graphs, and algorithms.	Level-1 Remember
CO2	**Explain** the working principles, memory representation, traversal methods, searching, sorting, recursion, hashing, and tree and graph operations in data structures.	Level-2 Understand
CO3	**Apply** algorithms and operations related to arrays, linked lists, stacks, queues, hashing techniques, recursion, trees, and graph traversal.	Level-3 Apply
CO4	**Analyze** the performance, complexity, and suitability of data structures and algorithms using appropriate searching, sorting, hashing, recursion, tree, and graph techniques.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Introduction and Overview: Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Tradeoff.

Arrays: Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging. Searching: Linear Search and Binary Search, Comparison of Methods. Sorting: Bubble Sort, Selection Sort, and Insertion Sort. Two- Dimensional Arrays, Representation of Two Dimensional Arrays in Memory, Matrices and Sparse Matrices, Multi-Dimensional Arrays.

UNIT -II

Linked Lists: Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List .Applications of Linked Lists: Addition of Polynomials.

Hashing and Collision: Hashing, Hash Tables, Types of Hash Functions, Collision, and Collision Resolution with Open Addressing and Chaining.

UNIT- III

Stacks: Definition, Representation of Stacks using Arrays and Linked List, Operations on Stacks using Arrays and Linked List, Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Post fix Expression, Evaluation of Postfix Expression.

Recursion: Definition, Recursive Notation, and Runtime Stack, Applications of Recursion: Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi.

Queues: Definition, Representation of Queues using Array and Linked List, Types of Queue: Simple Queue, Circular Queue, Double-Ended queue, Priority Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues.

UNIT- IV

Graphs: Definition, Terminology, Representation, Traversal.

Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree, Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL Tree.

Suggested Readings:

1. R.B. Patel, “Expert Data Structures with C”, Khanna Book Publishing Company, 2023 (AICTE Recommended Textbook)
2. Seymour Lipschutz, “Data Structures with C”, Schaum’s Outlines, Tata McGraw-Hill, 2011.
3. YashavantKanetkar,"Data Structures Through C",4th Edition, BPB Publications,2022.
4. ReemaThareja, “Data Structures Using C", Second Edition, Oxford University Press, 2014.
5. Ellis Horowitz, SartajSahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2007.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Arrays	https://youtu.be/INP2KnKZ5Tc?si=6givm9e8nsbc7yt8\
Unit-II	Linked Lists	https://youtu.be/sjVFxIJ92P0?si=F-qmIA-Asl4gT0t1
Unit-III	Stacks	https://youtu.be/zv0hUsIsHms?si=UpWAyyVMZG8O89nu
Unit-IV	Graphs	https://youtu.be/pcXxSM7caDI?si=U_Fk1RLSk_j-i_3r

Course Code	**LC-BCA-108B**				
Category	Core Courses				
Course Title	**Data Structure Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • To understand the basic concepts of data structures and their significance in problem solving. • To develop programs for performing operations on arrays including insertion, deletion, searching, sorting, merging, and matrix operations. • To implement and perform operations on linear data structures such as Singly Linked List, Doubly Linked List, and Circular Linked List				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Apply** programming concepts to implement array operations, searching, sorting, and matrix operations.	Level-3 Apply
CO2	**Analyze** and implement linked list operations including singly, doubly, and circular linked lists.	Level-4 Analyze
CO3	**Evaluate** stack and queue implementations using arrays and linked lists for solving problems like postfix evaluation and polynomial addition.	Level-5 Evaluate
CO4	**Create** solutions using recursion and advanced data structures such as circular queues and binary search trees.	Level-6 Create

List of Experiments:

Exp. No.	Contents
1.	Write a program for insertion and deletion operations in an array.
2.	Write a program to search for an element in an array using Linear Search and Binary Search.
3.	Write a program to sort an array using Bubble Sort, Selection Sort and Insertion Sort.
4.	Write a program to merge two arrays.
5.	Write a program to add and subtract two matrices.
6.	Write a program to multiply two matrices.
7.	Write a program to insert an element into a Singly Linked List: a. At the beginning b. At the end c. At a specified position
8.	Write a program to delete an element from a Singly Linked List: a. At the beginning b. At the end c. A specified element
9.	Write a program to perform the following operations in a Doubly Linked List: a. Create b. Search for an element
10.	Write a program to perform the following operations in a Circular Linked List: a. Create b. Search for an element
11.	Write a program to implement stack operations using an array.

12.	Write a program to implement stack operations using a linked list.
13	Write a program to add two polynomials using a linked lists.
14	Write a program to evaluate a post fix expression using a stack.
15	Write a program to perform the following using recursion: a. Find the factorial of a number. b. Find the GCD of two numbers. c. Solve Towers of Hanoi problem.
16	Write a program to implements queue operations using an array.
17	Write a program to implement circular queue operations using an array.
18	Write a program to implement circular queue operations using a linked list.
19	Write a program to perform insertion operation in a binary search tree.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**CC-BCA-110B**				
Category	Core Courses				
Course Title	**Operating Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • To develop understanding of operating system concepts, structures, types, components, and services. • To develop ability to explain process management, multithreading, and CPU scheduling algorithms. • To develop skills to apply process synchronization techniques and handle deadlocks effectively.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	RBT Level
CO1	**Recall** the basic concepts, components, services, types, and structures of operating systems.	Level-1 Remember
CO2	**Explain** process concepts, states, threads, and CPU scheduling algorithms including their benefits and performance evaluation.	Level-2 Understand
CO3	**Apply** process synchronization mechanisms and deadlock handling techniques to solve inter-process communication and critical section problems.	Level-3 Apply
CO4	**Analyze** memory management techniques, virtual memory, and paging, segmentation, and I/O management including disk scheduling for efficient system performance.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT -I

Operating Systems Overview: Definition, Evaluation of O.S, Components & Services of OS, Structure, Architecture, types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems.

Operating Systems Structures: Operating system services and systems calls, system programs, operating system structure, operating systems generations.

UNIT -II

Process Management: Process Definition, Process states, Process State transitions, Process Scheduling, Process Control Block, Threads, Concept of multithreads, Benefits of threads, Types of threads.

Process Scheduling: Definition, Scheduling objectives, Scheduling algorithms, CPU scheduling Preemptive and Non-preemptive Scheduling algorithms (FCFS, SJF and RR), Performance evaluation of the scheduling Algorithms

UNIT -III

Process Synchronization: Introduction, Inter-process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors.
Deadlocks: System model, deadlock characterization, deadlock prevention, avoidance, Banker's algorithm, Deadlock detection, and recovery from deadlocks.

UNIT -IV

Memory Management: Logical and Physical address map, Swapping, Memory allocation, MFT, MVT, Internal and External fragmentation and Compaction, Paging, Segmentation.

Virtual Memory: Demand paging, Page Replacement algorithms, Allocation of frames, thrashing.
I/O Management: Principles of I/O Hardware: Disk structure, Disk scheduling algorithms.

Suggested Readings:

1. EktaWalia, Operating Systems Concepts , Khanna Publishing House,2022(AICTE Recommended Textbook)
2. Abraham Silberschatz ,Peter Baer Galvin,Greg Gagne (2006),Operating System Principles, 7th edition OR Later edition, Wiley India Private Limited, New Delhi.
3. Stallings (2006), Operating Systems, Internal sand Design Principles, 5th edition, Pearson Education, India.
4. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India.
5. SumitabhaDas,UNIX Concepts and Applications, 4th Edition, Tata McGraw-Hill.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Operating Systems	https://youtu.be/a2B69vCtjOU?si=nyg_rs8mUCNq2PHD
Unit-II	Process Management	https://youtu.be/g_kLI2pkNC4?si=UsQ20Ekuya_6F2vl
Unit-III	Process Synchronization	https://youtu.be/JOaBNuXgqqw?si=Zd9q7pAF-tr2q4mZ
Unit-IV	Memory Management	https://youtu.be/_pKbqFyG03s?si=V7buPm3hRq-j34KF

Course Code	**LC-BCA-114B**				
Category	Core Courses				
Course Title	**Operating System Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	2	**1**	
Course Objectives	The objectives of this course are to • To develop understanding of CPU scheduling algorithms. • To develop ability to implement deadlock handling techniques. • To develop skills in process synchronization and inter-proces communication.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	3Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	**Skills Demonstrated**	**RBT Level**
CO1	**Apply** C programming to implement CPU scheduling algorithms such as FCFS, SJF, and Round Robin.	Level-3 Apply
CO2	**Analyze** process synchronization and deadlock handling using problems like Producer–Consumer, Dining Philosophers, and Banker's Algorithm.	Level-4 Analyze
CO3	**Evaluate** memory management techniques including paging, segmentation, and contiguous allocation methods (First Fit, Best Fit).	Level-5 Evaluate
CO4	**Create** solutions for operating system concepts such as IPC using pipes, page replacement (FIFO), and file allocation methods.	Level-6 Create

List of Experiments:

Exp. No.	**Contents**
1	Write C program to simulate the FCFS CPU Scheduling algorithm.
2	Write C program to simulate the SJF CPU Scheduling algorithm
3	Write C program to simulate the Round Robin CPU Scheduling algorithm.
4	Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
5	Write a C program to implement the Producer–Consumer problem using semaphores.
6	Write a C program to illustrate the IPC mechanism using Pipes.
7	Write a C program to simulate Paging memory management technique
8	Write a C program to simulate Segmentation memory management technique.
9	Write a C program to simulate the Best Fit contiguous memory allocation technique.
10	Write a C program to simulate the First Fit contiguous memory allocation technique.
11	Write a C program to simulate the concept of Dining-Philosophers problem.
12	Write a C program to implement FIFO page replacement technique
13	Write a C program that demonstrates the implementation of the sequential file allocation method

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**SEC-BCA-102B**				
Category	Skill Enhancement Courses				
Course Title	**Object Oriented Programming using Java**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • To introduce the object oriented programming system concepts • To introduce syntax and semantics of Java programming language • To develop modular programs using Java • To setup JDK environment to create, debug and run Java programs				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Recall** the basic concepts, benefits, applications of OOP, and features of Java, including Java program structure and environment.	Level-1 Remember
CO2	**Explain** Java data types, variables, operators, expressions, control statements, and looping mechanisms.	Level-2 Understand
CO3	**Apply** object-oriented concepts to design classes, methods, inheritance, polymorphism, and handle arrays, strings, and vectors in Java programs.	Level-3 Apply
CO4	**Analyze** and implement Java packages and exception handling mechanisms to create modular and robust programs.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Fundamentals of Object Oriented Programming: Basic Concepts of Object Oriented Programming (OOP), Benefits and Applications of OOP.

Java Evolution: Java Features, Difference between Java, C and C++, Java and Internet, Java Environment.

Overview of Java Language: Introduction to Simple Java Program, Use of Comments and Math function, Application of two classes, Java Program Structure, Java Tokens and statements, Implementing Java program And JVM, Command Line Arguments.

UNIT -II

Constants, Variables and Data Types: Constants, Variables, Data Types, Declaration of Variables, Giving values to Variables, Symbolic Constants, Type casting.

Operators & Expressions: Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, conditional operators, Bitwise operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence & Associativity.

Decision Making, Branching & Looping: Decision Making with Control Statements, Looping statements, Jump in loops, Labelled loops.

UNIT- III

Classes, Objects and Methods: Defining Class, Methods Declaration, Constructors, Methods Overloading, Overriding Methods, Inheritance

Arrays, Strings and Vectors: 1D arrays, Creating an Array, 2D arrays, Strings, Vectors,

Wrapper Classes, Enumerated Types

Inheritance: Defining, extending classes, and Implementing Interfaces. Multiple inheritance and polymorphism.

UNIT -IV

Packages: Basics of packages, System packages, Creating and accessing packages, creating user defined packages, Adding class to a package.

Exception Handling: Using the main keywords of exception handling: try, catch, throw, throws and finally; Nested try, multiple catch statements, creating user defined exception

Suggested Readings:

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer.7th edition. India: McGraw Hill Education
2. Schildt, H. (2022). Java: The Complete Reference. 12th edition. McGraw- Hill Education.
3. AruneshGoyal,The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
4. TanweerAlam , Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
5. Y.Daniel Liang, Introduction to Java Programming,7th Edition, Pearson, 2008.
6. S.Malhotra and S.Choudhary,Programming in Java, 2nd Edition, Oxford University Press, 2014.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Object Oriented Programming	https://youtu.be/K3g4srbkUNM?si=T6ZFXp78zbROTUKZ
Unit-III	Classes, Objects and Methods	https://youtu.be/GKLL2q6UkHQ?si=Lrx99qYCSIgCTnoT
Unit-IV	Packages	https://youtu.be/TwU3cv1FFis?si=DkfTsgxVnKxrYFU

Course Code	**LC-BCA-118B**				
Category	Skill Enhancement Courses				
Course Title	**Object Oriented Programming using Java Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • To develop understanding of basic Java programming concepts, syntax, and command line arguments. • To develop ability to implement control structures, recursion, arrays, and matrix operations in Java programs. • To develop skills in object-oriented programming including classes, objects, inheritance, polymorphism, and interfaces.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	**Skills Demonstrated**	**RBT Level**
CO1	**Apply** Java programming concepts to implement basic programs using command line arguments, arrays, strings, recursion, and matrix operations.	Level-3 Apply
CO2	**Analyze** object-oriented programming concepts by implementing classes, objects, inheritance, polymorphism, and interfaces in Java.	Level-4 Analyze
CO3	**Evaluate** Java programs using packages, file handling, and string processing to manage and organize data effectively.	Level-5 Evaluate
CO4	**Create** robust Java applications using exception handling and user-defined exceptions to manage runtime errors.	Level-6 Create

List of Experiments:

Exp. No.	**Contents**
1	Write a program to read two numbers from user and print their product
2	Write a program to print the square of anumber passed through command line arguments
3	Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student
4	Write a java program to find the largest number out of n natural numbers.
5	Write a java program to find the Fibonacci series & Factorial of a number using recursive and non-recursive functions
6	Write a java program to multiply two given matrices
7	Write a Java program for sorting a given list of names in ascending order
8	Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome
9	Write a java program to read n number of values in an array and display it in reverse order
10	Create a Java class named Student that includes the following attributes: USN, Name, Branch, Phone, and Percentage. Then, write a Java program to create n Student objects and display their USN, Name, Branch, Phone, and Percentage with appropriate headings.
11	Write a Java program that displays the number of characters, lines and words in a text
12	Write a Java program to create a class called Shape with methods called get Perimeter () and get Area (). Create a subclass called Circle that overrides the get Perimeter () and get Area () methods to calculate the area and perimeter of a circle.

13	Write a Java program to create a class Employee with a method called calculate Salary ().Create two subclasses Manager and Programmer. In each subclass, override the calculate Salary() method to calculate and return the salary based on their specific roles
14	Write a Java program using an interface called 'Bank' having function 'rate_ of_ interest ()'. Implement this interface to create two separate bank classes 'SBI 'and 'PNB 'to print different rates of interest. Include additional member variables, constructors also in classes 'SBI' and 'PNB'.
15	Write a Java package program for the class book and the import the data from the package and display the result.
16	Write a Java program for finding the cube of a number using a package for various data types and then import it in another class and display the results
17	Write a Java program for demonstrating the divide by zero exception handling
18	Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates
19	Create an exception subclass Under Age, which prints "Under Age" along with the age value when an object of Under Age class is printed in the catch statement. Write a class exception Demo in which the method test () throws Under Age exception if the variable age passed to it as argument is less than 18. Write main () method also to show working of the program

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**SEC-BCA-104B**				
Category	Skill Enhancement Courses				
Course Title	**Web Technologies**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	1	0	0	**1**	
Course Objectives	The objectives of this course are • To understand the fundamental concepts of web technologies including HTML, CSS, and Bootstrap for web page design. • To understand client-side scripting using JavaScript for dynamic content creation and form validation. • To understand advanced web technologies such as AJAX, XML, and JSON for developing interactive web applications.				
Assessment	05 Marks				
End Semester Examination	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the fundamental concepts of web technologies including HTML, CSS, JavaScript, XML, and JSON.	Level-1 Remember
CO2	**Explain** the structure, styling, and scripting techniques used in web development along with client-server concepts.	Level-2 Understand
CO3	**Apply** web development tools and technologies such as HTML forms, CSS styling, Bootstrap, and JavaScript functions to build interactive web pages.	Level-3 Apply
CO4	**Analyze** the functionality of web applications using AJAX, XML, and JavaScript-based validation and event handling techniques.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts of 1 mark each from all units and remaining 8 questions of 4 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Introduction to HTML, history of HTML, Objective, basic Structures of HTML, Header Tags, body tags, Paragraph Tags. Tags for FORM Creation, TABLE, FORM, TEXTAREA, SELECT, IMG, IFRAME
FIELDSET, ANCHOR. Lists in HTML, Introduction to DIV tag, NAVBAR Design.

UNIT – II

Introduction to CSS, types, Selectors, and Responsiveness of a web page. Introduction to Bootstrap, downloads/linking, using classes of Bootstrap, understanding the Grid System in Bootstrap. Introduction to www, Protocols and Programs, Applications and development tools, web browsers, DNS, Web hosting Provider, Setting up of Windows/Linux/Unix web servers, Web hosting in cloud, Types of Web Hosting.

UNIT – III

Introduction to JavaScript: Functions and Events, Document Object model traversing using JavaScript. Output System in JavaScript i.e. Alert, throughput, Input box, Console. Variables and Arrays in JavaScript. Date and String handling in JavaScript.

UNIT – IV

Manipulating CSS through JavaScript: Form Validation like Required validator, length validator, Pattern validator. Advanced JavaScript, Combining HTML, CSS and JavaScript events and buttons, controlling your browser.Introduction to AJAX, Purpose, advantages and disadvantages, AJAX based Web applications and alternatives of AJAX.
Introduction to XML: uses, Key concepts, DTD 8 schemas, XSL, XSLT,and XSL Elements and transforming with XSLT. Introduction to XHTML.JSON: Introduction to JSON, Keys and Values, Types of Values, Arrays, Objects.

Reference Books

- Laura Lemay, Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016
- Thomas A. Powell, The Complete Reference HTML & CSS, Fifth Edition, 2017 Reference Books
- Silvio Moreto, Bootstrap 4 By Example, ebook, 2016.
- Tanweer Alam, Web Technologies, Khanna Book Publishing, 2011.

Course Code	**LC-BCA-120B**				
Category	Skill Enhancement Courses				
Course Title	**Web Technologies Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: • To understand the fundamentals of web development using HTML, CSS, JavaScript, XML, and related technologies for designing structured web pages. • To understand the application of client-side scripting, form validations, and dynamic content handling using JavaScript and AJAX. • To understand the concepts of data representation and transformation using XML, DTD, XSD, XSL, and JSON in web applications.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Apply** HTML, CSS, and JavaScript concepts to design and develop structured and interactive web pages.	Level-3 Apply
CO2	**Analyze** web page layouts, styling techniques, and client-side scripting for dynamic web application behavior.	Level-4 Analyze
CO3	**Evaluate** web technologies such as AJAX, XML, JSON, and validation methods for effective web development solutions.	Level-5 Evaluate
CO4	**Create** responsive and dynamic web applications using HTML, CSS, JavaScript, and supporting web technologies.	Level-6 Create

List of Experiments:

Exp. No.	Contents
1	Create your class time table using table tag.
2	Design a Webpage for your college containing description of courses, department, faculties, library etc. using list tags, href tags, and anchor tags.
3	Create web page using Frame with rows and columns where we will have header frame, left frame, right frame, and status bar frame. On clicking in the left frame, information should be displayed in right frame.
4	Create Your Resume using HTML, use text, link, size, color and lists.
5	Create a Web Page of a super market using (internal CSS).
6	Use Inline CSS to format your resume that you have created.
7	Use External CSS to format your time table created.
8	Use all the CSS (inline, internal and external) to format college web page that you have created.
9	Write a HTML Program to create your college website using for mobile device.
10	Write an HTML/JavaScript page to create login page with validations.
11	Develop a Simple calculator for addiction, subtraction, multiplication and division operation using JavaScript.

12	Use Regular Expressions for validations in Login Page using JavaScript.
13	Write a Program to retrieve date from a text file and displaying it using AJAX.
14	Create XML file to store Student Information like Register Number, Name, Mobile Number, DOB, and Email-Id.
15	Create XSL file to convert XML file to XHTML file.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**VAC-BCA-102B**				
Category	Value Added Courses				
Course Title	**Indian Constitution**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	2	0	0	**2**	
Course Objectives	The objectives of this course are: • To understand the historical background, Preamble, Basic Structure, Fundamental Rights, Fundamental Duties, and Directive Principles of the Constitution of India. • To understand the structure, powers, and functions of the Union and State Governments. • To analyze the roles and functions of local administration and constitutional authorities in democratic governance. • To recognize the significance of the Election Commission and the constitutional framework in ensuring free, fair, and effective governance.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	3Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** the history, Preamble, Basic Structure, Fundamental Rights, Fundamental Duties, and Directive Principles of the Constitution of India.	Level-1Remember
CO2	**Explain** the structure, powers, and functions of the Union Government and the State Government.	Level-2Understand
CO3	**Apply** the principles of constitutional governance in the functioning of the Union, State, and Local Administration.	Level-3Apply
CO4	**Analyze** the role of constitutional institutions, including the Union Government, State Government, Local Administration, and the Election Commission, in strengthening Indian democracy.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

The Constitution-Introduction:

The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation, State Policy Principles.

Unit -II

Union Government:

Structure of the Indian Union, President–Role and Power, Prime Minister and Council of Ministers, LokSabha and RajyaSabha.

Unit- III

State Government:
Governor–Role and Power**,** Chief Minister and Council of Ministers**,** State Secretariat.

Unit -IV

Local Administration and Election Commission:
District Administration, Municipal Corporation, ZilaPanchayat, Election Commission:Role and Functioning; Chief Election Commissioner; State Election Commission

Suggested Readings:

- Ethics and Politics of the Indian Constitution by Rajeev Bhargava, Oxford University Press, New Delhi, 2008
- The Constitution of India by B.L. FadiaSahityaBhawan; New edition (2017)
- Introduction to the Constitution of India by DDBasuLexisNexis;Twenty-Third,2018 edition
- Cases
- RustomCavasjeeCooperv. Union of India, (1970) 1SCC248
- State of Rajasthan v. Mohan Lal Vyas, AIR 1971 SC 2068 (confirmation of a private monopoly, not a violation of fundamental right)
- MithileshGargv.UnionofIndia,(1992)1SCC168:AIR1992SC221(Righttocarryon business, not breached when it is liberalised)
- Chintamanrao v. The State of Madhya Pradesh, AIR 1951 SC 118 (scope of reasonable restrictions in relation to trade and occupation)
- Cooverjee B. Bharucha v. Excise Commissioner, Ajmer, AIR 1954 SC 220 (the reasonablenessoftherestrictionimposedmaydependuponthenatureofthebusinessand prevailing conditions including public health and morality)
- T.B.Ibrahimv.RegionalTransportAuthority.Tanjore,AIR1953SC79
- HarmanSinghv.RTA,Calcutta,AIR1954SC190
- Dwarka Prasad LaxmiNarainv. State of U.P., AIR1954SC224
- State of Bombay v. R.M.D. Chamarbaugwala, AIR1957SC699
- Parbhani Transport Coop. Society Ltd. v. Regional Transport Authority, Aurangabad, AIR 1960 SC 801
- State of Bombayv. R.M.D. Chamarbaugwala,(1957)S.C.R.874,
- G.K. Krishnan vs State of TamilNadu, 1975SCC(1)375
- Automobile Transport (Rajasthan Ltd. Vs State of Rajasthan, AIR1962SC1406

Useful Video Links:

Unit No.	Topics	Links
Unit-I	The Constitution-Introduction	https://youtu.be/0DbQ_Eq8wJ0?si=oqdHYKQ5sdOk4Foc
Unit-II	Union Government	https://youtu.be/qZd39cdEJgA?si=_b4cGMR8JAN_3KL9
Unit-III	State Government	https://youtu.be/qZd39cdEJgA?si=1qfpidO28RjbvVE4
Unit-IV	Local Administration and Election Commission	https://youtu.be/a0_FuX41GzU?si=MFnYp0e5xbOy0trh

Course code	**AEC-BCA-102B**				
Category	Additional Courses				
Course title	**Hindi**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	1	1	0		
Course Objectives	The objectives of this course are • विद्यार्थियोंकोहिन्दीभाषाकेमहत्त्वएवंगुणवत्तासेसुविज्ञकरवाकरहिन्दीकीओरउन्मुखकरना। • विद्यार्थियोंकोहिन्दीभाषाकीवैज्ञानिकताकेविषयमेंबतलाकरइसकेगौरवसेसुपरिचितकरवाना। • हिन्दीभाषाकेमाध्यमसेनवयुवक-नवयुवतियोंकोराष्ट्रीयताकेपुनीतभावोंकीओरउन्मुखकरना।				
Assessment	50 Marks				
End Semester Examination	-				
Total	50 Marks				
Remarks	An '**Additional Course'** is a non-credit Ability-Enhancement Course that is undertaken for learning purposes only. If completed, the '**Additional Course'** may be recorded. The **Additional Course (Ability Enhancement Course)** is included as a qualifying paper and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students. .				

Course Outcomes: After studying this course, the students will be able to

CO	Skills Demonstrated	RBT Level
CO1	लिपिभाषाऔरसाहित्यकेबुनियादीसिद्धांतोंकाअवलोकनकरें।	Level-1 Remember
CO2	भाषाकीसंरचनाएअर्थऔरअभिव्यक्तिकेपहलुओंकीसमझविकसितकरें।	Level-2 Understand
CO3	भाषाईऔरसाहित्यिकसिद्धांतोंकोवास्तविकजीवनमेंलागूकरनेकीक्षमताप्राप्तकरें।	Level-3 Apply
CO4	भाषा,लिपिऔरसाहित्यकेविभिन्नपहलुओंकाविश्लेषणकरकेजटिलसाहित्यिकऔरसांस्कृतिकमुद्दोंकोसमझें।।	Level 4 Analyze

Unit -I

लिपिकामानकीकरणमानकवर्णमाला,देवनागरीअंकमाला,अनुस्वारऔरविसर्ग,अनुनासिक,वर्तनीकीशुद्धताकेलिएध्यानदेनेयोग्यबातें , वर्तनीसंबंधीअशुद्धियोंकेकारण,वर्तनीसंबंधीअशुद्धियोंकोदूरकरनेकेउपाय।

Unit-II

सृजनात्मकसाहित्यकाअर्थ,परिभाषाऔरस्वरूपःआलोचनात्मकसाहित्यकाअर्थ,परिभाषाऔरस्वरूपःसृजनात्मकसाहित्यकाभाषाविकासमेंमहत्त्व, निबंधलेखन,कहानीलेखन,काव्यलेखन।

Unit-III

अनुवादअर्थ,परिभाषाऔरस्वरूपवअनुवादकामहत्त्व, अनुवादककेगुण, अनुवादकेप्रकार,अनुवादमेंकंप्यूटरकायोगदान, सीरियलोंकाहिंदीअनुवाद,बैंकिंगसाहित्यकाअनुवाद,डबिंगक्षेत्रमेंअनुवाद,लिप्यंतरण,हिंदीसाहित्यकाअन्यभाषाओंमेंअनुवाद,अनुवादक्षेत्रमेंरोजगार।

Unit-IV

पत्रप्रस्तुतीकरणकाअर्थ,पत्रप्रस्तुतीकरणऔरनवीनशोधात्मकवैचारिकता,पत्रप्रस्तुतीकरणऔरशिक्षककीभूमिका,प्रस्तोताकामनोबल ,वक्तृत्वकलाकाविकास, शोधात्मकअभिरुचिकाविकास

प्रेरणास्पदपुस्तकें:

- शुद्धलेखनऔरहिन्दीकामानकरूप—डॉ०हरिश्चन्द्रवर्मा,विद्याभारती,संस्कृतिशिक्षासंस्थान,कुरुक्षेत्र(हरियाणा)।
- बृहद्हिन्दीकोश— सम्पा०कालिकाप्रसाद,राजवल्लभसहाय,मुकुन्दीलालश्रीवास्तव,ज्ञानमण्डललिमिटेड,वाराणसी।
- परिशोध—मुख्यसम्पादक:डॉ०लक्ष्मीनारायणशर्मा,मानव-मूल्यविशेषांक, 1993।
- भारतीयजीवनमूल्य—डॉ०धर्मपालमैनी, भारतीयसंस्कृतिसंस्थान,गुड़गाँव।
- बृहत्प्रशासनशब्दावली(हिन्दी-अंग्रेजी) — वैज्ञानिकतथातकनीकीशब्दावलीआयोग,नईदिल्ली-110006।
- बृहत्प्रशासनशब्दावली(अंग्रेजी-हिन्दी) —वैज्ञानिकतथातकनीकीशब्दावलीआयोग, नईदिल्ली-110006।
- बृहत्पारिभाषिकशब्द-संग्रह(मानविकी), खंड-1 — वैज्ञानिकतथातकनीकीशब्दावलीआयोग,केन्द्रीयहिन्दीनिदेशालय,शिक्षातथासमाजकल्याणमंत्रालय,भारतसरकार।
- प्रयोजनमूलकअनुवाद— डॉ०सुरेशसिंघल, मोनिकाप्रकाशन, दिल्ली-110053।
- अनुवादसिद्धान्तएवंव्यवहार—डॉ०सुरेशसिंघल,अभिनवप्रकाशन,दिल्ली-6।

Useful Video links:

Unit No	Topics	Links
Unit-I	लिपिकामानकीकरण	https://www.youtube.com/watch?v=g1jcWLojnj4&t=2s
Unit-II	सृजनात्मकसाहित्यकाअर्थ	https://www.youtube.com/watch?v=aUOgArzWtTU
Unit-III	अनुवाद	https://www.youtube.com/watch?v=B1-xF-WBDXI
Unit-IV	प्रस्तुतीकरणकाअर्थ	https://www.youtube.com/watch?v=NkXI3lgDkrw

Annexure AC/5.41

Re-entry Criteria into Second Year (Third Semester)

The student who takes an exit after one year with an award of certificate may be allowed to re-enter into third Semester for completion of the BCA Program as per the Institute's schedule after earning requisite credits in the First year.

Scheme of Studies and Examination
BCA – 3rd Semester
(BCA)
w.e.f 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Assessment	End Semester Exam	Practical	Total
1	Core Courses	CC-BCA-201B	Design and Analysis of Algorithm	3	0	0	3	3	25	50	-	75
2	Core Courses	CC-BCA-203B	Database Management System	3	0	0	3	3	25	50	-	75
		LC-BCA-205B	Database Management System Lab	0	0	4	4	2	15	-	35	50
3	Core Courses	CC-BCA-207B	Software Engineering	3	0	0	3	3	25	50	-	75
4	Skill Enhancement Courses	SEC-BCA-201B	Python Programming	2	0	0	2	2	15	35	-	50
		LC-BCA-209B	Python Programming Lab	0	0	4	4	2	15	-	35	50
5	Discipline Specific Elective	DSE-BCA-201B	Computer Graphics	1	0	0	1	1	05	20	-	25
		LC-BCA-211B	Computer Graphics Lab	0	0	4	4	2	15	-	35	50
6	Value Added Courses	Refer Table No.- II	…….	0	0	4	4	2	15	-	35	50
			Total Credits					**20**				**500**

Students can choose their specialization i.e. Stream with Discipline Specific Elective[DSE] from Second year onwards(Appendix-I).

A minimum of TWENTY students is required to offer any specialization area. The specialization area opted for in the 3rd Semester would remain the same in all further semesters.

Scheme of Studies and Examination
BCA – 3rd Semester
(Data Science)
w.e.f 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Assessment	End Semester Exam	Practical	Total
1	Core Courses	CC-BCA-201B	Design and Analysis of Algorithm	3	0	0	3	3	25	50	-	75
2	Core Courses	CC-BCA-203B	Database Management System	3	0	0	3	3	25	50	-	75
		LC-BCA-205B	Database Management System Lab	0	0	4	4	2	15	-	35	50
3	Core Courses	CC-BCA-207B	Software Engineering	3	0	0	3	3	25	50	-	75
4	Skill Enhancement Courses	SEC-BCA-201B	Python Programming	2	0	0	2	2	15	35	-	50
		LC-BCA-209B	Python Programming Lab	0	0	4	4	2	15	-	35	50
5	Discipline Specific Elective	DSE-BCA-DS-201B	Basics of Data Analytics using Spreadsheet	1	0	0	1	1	05	20	-	25
		LC-BCA-DS-203B	Basics of Data Analytics using Spreadsheet Lab	0	0	4	4	2	15	-	35	50
6	Value Added Courses	Refer Table No.- II	…….	0	0	4	4	2	15	-	35	50
Total Credits								**20**				**500**

Scheme of Studies and Examination
BCA – 3rd Semester
(Artificial Intelligence & Machine Learning)
w.e.f 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Assessment	End Semester Exam	Practical	Total
1	Core Courses	CC-BCA-201B	Design and Analysis of Algorithm	3	0	0	3	3	25	50	-	75
2	Core Courses	CC-BCA-203B	Database Management System	3	0	0	3	3	25	50	-	75
		LC-BCA-205B	Database Management System Lab	0	0	4	4	2	15	-	35	50
3	Core Courses	CC-BCA-207B	Software Engineering	3	0	0	3	3	25	50	-	75
4	Skill Enhancement Courses	SEC-BCA-201B	Python Programming	2	0	0	2	2	15	35	-	50
		LC-BCA-209B	Python Programming Lab	0	0	4	4	2	15	-	35	50
5	Discipline Specific Elective	DSE-BCA-AIML-201B	Feature Engineering	1	0	0	1	1	05	20	-	25
		LC-BCA-AIML-203B	Feature Engineering Lab	0	0	4	4	2	15	-	35	50
6	Value Added Courses	Refer Table No.- II	….....	0	0	4	4	2	15	-	35	50
			Total Credits					**20**				**500**

Scheme of Studies and Examination
BCA – 4th Semester
(BCA)
w.e.f 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Assessment	End Semester Exam	Practical	Total
1	Core Courses	CC-BCA-202B	Entrepreneurship and Startup Ecosystem	1	1	0	2	2	15	35	-	50
2	Core Courses	CC -BCA-204B	Computer Networks	3	0	0	3	3	25	50	-	75
		LC-BCA-206B	Computer Networks Lab	0	0	4	4	2	15	-	35	50
3	Core Courses	CC -BCA-208B	Probability and Statistics	3	0	0	3	3	25	50	-	75
4	Core Courses	CC -BCA-210B	Artificial Intelligence	3	0	0	3	3	25	50	-	75
		LC-BCA-212B	Artificial Intelligence Lab	0	0	4	4	2	15	-	35	50
5	Discipline Specific Elective	DSE-BCA-202B	Advance Database System	1	0	0	1	1	05	20	-	25
		LC-BCA-214B	Advance Database System Lab	0	0	4	4	2	15	-	35	50
6	Skill Enhancement Courses	SEC-BCA-202B	Design Thinking and Innovation	1	1	-	2	2	15	35	-	50
Total Credits								**20**				**500**

Scheme of Studies and Examination
BCA – 4th Semester
(Data Science)
w.e.f 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Assessment	End Semester Exam	Practical	Total
1	Core Courses	CC-BCA-202B	Entrepreneurship and Startup Ecosystem	1	1	0	2	2	15	35	-	50
2	Core Courses	CC -BCA-204B	Computer Networks	3	0	0	3	3	25	50	-	75
		LC-BCA-206B	Computer Networks Lab	0	0	4	4	2	15	-	35	50
3	Core Courses	CC -BCA-208B	Probability and Statistics	3	0	0	3	3	25	50	-	75
4	Core Courses	CC -BCA-210B	Artificial Intelligence	3	0	0	3	3	25	50	-	75
		LC-BCA-212B	Artificial Intelligence Lab	0	0	4	4	2	15	-	35	50
5	Discipline Specific Elective	DSE-BCA-DS-202B	Data Visualization	1	0	0	1	1	05	20	-	25
		LC-BCA-DS-204B	Data Visualization Lab	0	0	4	4	2	15	-	35	50
6	Skill Enhancement Courses	SEC-BCA-202B	Design Thinking and Innovation	1	1	-	2	2	15	35	-	50
Total Credits								**20**				**500**

Scheme of Studies and Examination
BCA – 4th Semester
(Artificial Intelligence & Machine Learning)
w.e.f 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Assessment	End Semester Exam	Practical	Total
1	Core Courses	CC-BCA-202B	Entrepreneurship and Startup Ecosystem	1	1	0	2	2	15	35	-	50
2	Core Courses	CC -BCA-204B	Computer Networks	3	0	0	3	3	25	50	-	75
		LC-BCA-206B	Computer Networks Lab	0	0	4	4	2	15	-	35	50
3	Core Courses	CC -BCA-208B	Probability and Statistics	3	0	0	3	3	25	50	-	75
4	Core Courses	CC -BCA-210B	Artificial Intelligence	3	0	0	3	3	25	50	-	75
		LC-BCA-212B	Artificial Intelligence Lab	0	0	4	4	2	15	-	35	50
5	Discipline Specific Elective	DSE-BCA-AIML-202B	Introduction to ML	1	0	0	1	1	05	20	-	25
		LC-BCA-AIML-204B	Introduction to ML Lab	0	0	4	4	2	15	-	35	50
6	Skill Enhancement Courses	SEC-BCA-202B	Design Thinking and Innovation	1	1	-	2	2	15	35	-	50
			Total Credits					**20**				**500**

Semester-III

Table No. II (Value Added Courses)

S. No.	Category	Course Code	Course Title
1	Value Added Courses	VAC-201B	Disaster Management
2	Value Added Courses	VAC-203B	Yoga and Physical Fitness
3	Value Added Courses	VAC-205B	Sports Management

Notes:

1. At the end of the Fourth Semester every student shall undergo Summer Training /Internship/ Capstone for Eight Weeks in the industry/Research or Academic Institute. This component will be evaluated during the fifth semester.
2. An **UNDER GRADUATE DIPLOMA IN COMPUTER APPLICATION** will be awarded, if a student wishes to exit at the end of Second year.

Exit Criteria after Second Year of BCA Programme

Students will have the option to exit the Bachelor of Computer Application (BCA) program after successfully completing the second year . Upon exit, they will be awarded a **UG Diploma in Computer Application**. To be eligible for this diploma, students must complete an additional 04 credits in one of the following areas:

1. **Skill-Based Subject**: A specialized course aimed at enhancing technical and practical expertise in computer applications.
2. **Work-Based Vocational Course**: A vocational course offered during the summer term, focused on building practical, industry-relevant skills.
3. **Internship/Apprenticeship**: A professional internship or apprenticeship with a minimum duration of 08 weeks, conducted after the fourth semester, offering hands- on experience in a relevant field.
4. **Social Responsibility & Community Engagement**: Involvement with an NGO or community-based organization for a minimum of 08 weeks, contributing to social initiatives and applying computer application knowledge to solve real-world challenges.
5. **Capstone Project**: Completion of a capstone project integrating the skills and knowledge gained during the first two years of the program, which can be an independent or group project.

The specific mode of completing the additional credits will be decided by the Institute and students will be required to complete the 08-week program or project during the summer term following their fourth semester.

Students opting for this exit will also be required to **submit an Internship/Apprenticeship Report** or complete the Capstone Project as per the schedule outlined by the Institute before they are awarded the UG Diploma.

SEMESTER-III

(Syllabi of Common Courses for all streams)

Course Code	**CC-BCA-201B**				
Category	**Core Courses**				
Course Title	**Design and Analysis of Algorithms**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts of algorithms, including time and space complexity and asymptotic notations. • To understand algorithm design techniques such as divide and conquer, greedy method, and dynamic programming along with their applications. • To understand graph algorithms, backtracking techniques, and the basics of computational complexity including P, NP, NP-complete, and NP-hard problems.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** fundamental concepts of algorithms, including time and space complexity, asymptotic notations, and analysis of basic algorithms such as searching, sorting, and recursion.	Level-1 Remember
CO2	**Explain** divide and conquer and greedy design techniques and their applications in sorting, searching, shortest path problems, and minimum spanning trees.	Level-2 Understand
CO3	**Apply** dynamic programming and graph algorithms to solve problems such as shortest paths, knapsack, and graph traversal techniques.	Level-3 Apply
CO4	**Analyze** backtracking methods and computational complexity concepts including P, NP, NP-complete, and NP-hard problem classes.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Algorithm: Definition of algorithm, Design and performance analysis of algorithms, time complexity, space complexity.

Asymptotic notations (O, Ω, Θ) to measure growth of a function and application to measure complexity of algorithms.

Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication.

Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem.

Unit- II

The Divide & Conquer Design Technique:
The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication.
Lower bound for comparison-based sorting.
The Greedy Design Technique:
The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.

Unit- III

The Dynamic Programming Design Technique:
The general concept. Computation of Fibonacci series and Binomial coefficients, all pair shortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem.
Algorithms on Graphs: Breadth First Search, Depth First Search, finding connected components, depth first search of a directed graph, topological sorting.

Unit -IV

Limitations of Algorithmic Power:
Backtracking Method: n-Queen problem; sum of subsets problem/ Hamiltonian circuit problem/vertex cover problem.
Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.

Suggested Readings:

- Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House (AICTE Recommended Textbook)
- Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford, Introduction to Algorithms, PHI publication, 3rd Edition, 2009.
- Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of Computer Algorithms, University Press (I) Pvt. Ltd., 2012.
- Levitin Anany, Introduction to Design and Analysis of Algorithms, 3rd Edition, Pearson, 2012
- Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis of Computer Algorithms, Addison Wesley Publications, Boston, 1983.
- Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006.

Useful Video links:

Unit No.	Topics	Links
1	Design and performance analysis of algorithms	https://nptel.ac.in/courses/106101060
2	The Greedy Design Technique	https://nptel.ac.in/courses/106106131
3	The Dynamic Programming Design Technique	https://nptel.ac.in/courses/106101060
4	NP-Complete	https://nptel.ac.in/courses/106101060

Course Code	**CC-BCA-203B**				
Category	**Core Courses**				
Course Title	**Database Management Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts of databases, DBMS, data models, and database design principles. • To gain knowledge of relational algebra, SQL, normalization, and transaction management for effective database handling. • To study advanced database technologies including NoSQL, Big Data, indexing, and database security concepts.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the basic concepts of data, database, DBMS, data models, keys, constraints, relational model, SQL, normalization, transactions, indexing, NoSQL, Big Data and database security.	Level-1 Remember
CO2	Explain database applications, data models, ER diagrams, SQL, normalization, transactions, indexing, NoSQL, CAP theorem, and security.	Level-2 Understand
CO3	Apply relational algebra, SQL queries, normalization techniques, and indexing methods to solve database problems.	Level-3 Apply
CO4	Analyze database designs, transaction concurrency control, indexing strategies, and NoSQL versus relational database systems.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Databases: Definition of Data, Database, and DBMS, Overview of Database Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators.

Data Models: Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS.

Database Design: Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER Features, Introduction to the Relational Model and Relational Schema.

Unit-II

Relational Algebra and Calculus: Introduction to Relational Algebra, Operations: Selection, Projection, Set Operations, Join Operations, Division, Tuple and Domain Relational Calculus

Structured Query Language (SQL): SQL Basics: DDL and DML, Aggregate Functions (Min( ), Max( ), Sum( ), Avg( ), Count( )), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses (Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right outer Join, Equi Join

Advanced SQL: Analytical queries, Hierarchical queries, Recursive queries, Views, Cursors, Stored Procedures and Functions, Packages, Triggers, Dynamic SQL.

Normalization and Database Design: Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization.

Unit-III

Transaction Management : ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Supporting SQL, Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlocks.

Database Storage and Indexing: Data on External Storage, File Organizations and Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection, Basic Examples of Index Selection.

Unit-IV

No SQL Databases and Big Data: Introduction to No SQL, Data Models: Document, Key value, Column family, Graph. Uses and Features of NO/SQL document databases. CAP theorem, BASE vs ACID, CRUD operations, Mongo DB operators, Overview of Big Data Technologies: Hadoop, MongoDB, Cassandra.

Database Security and Advanced Topics: Introduction to Database Security, Access Control, Discretionary Access Control, Introduction to Data Warehousing, OLAP, Data Mining

Suggested Readings:

- Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, third edition, McGraw–Hill, 2018
- Benjamin Rosenzweig, Elena Rakhimov, “Oracle PL/SQL by Example”, fifth edition, Prentice Hall, 2015
- Brad Dayley, “NoSQL with MongoDB in 24Hours”, 1st edition, Sams Publishing, 2024
- Korth, Silbertz, Sudarshan,” Database System Concepts”, Seventh Edition, McGraw - Hill.(2019)
- R. P. Mahapatra, Govind Verma, “Database Management Systems”, Khanna Publishing House, 2025.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Databases	https://nptel.ac.in/courses/106105175
Unit-II	Structured Query Language (SQL	https://youtu.be/w1XdPholzWY?si=vFjC72ql5JQiibX
Unit-III	Transaction Management	https://nptel.ac.in/courses/106105175
Unit-IV	No SQL Databases and Big Data	https://youtu.be/-s29jUAkg70?si=G4iGYPwXyfwc6r

Course Code	**LC-BCA-205B**				
Category	**Core Courses**				
Course Title	**Database Management Systems Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • Create and manipulate relational database tables (e.g., Supplier, Part, Supplies) using SQL commands, ensuring data integrity through appropriate constraints. • Analyze and retrieve meaningful data by performing JOIN operations and applying aggregate functions to solve real-world database problems. • Design and implement complex database systems using ER diagrams, SQL queries, PL/SQL procedures, triggers, and recursion to automate tasks and improve efficiency.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply SQL commands to create and manipulate database tables (e.g., Supplier, Part, Supplies), ensuring data integrity through constraints.	Level-3 Apply
CO2	Analyze the relationships between database tables using JOIN operations and aggregate functions to extract meaningful insights (e.g., total quantity supplied, supplier performance).	Level-4 Analyze
CO3	Evaluate the effectiveness of different SQL constraints (e.g., PRIMARY KEY, UNIQUE) and query optimization strategies (e.g., JOIN vs. sub queries) to ensure efficient data management.	Level-5 Evaluate
CO4	Create PL/SQL procedures, triggers, and recursive queries to automate data handling tasks and build efficient, scalable database systems.	Level-6 Create

List of Experiments:

Exp. No.	Contents
1.	Write SQL to create Supplier, Part, and Supplies tables and insert sample data, then display the results.
2.	Apply ALTER commands to modify the Supplier table (add state, change phone data type).
3.	Write a query to retrieve suppliers from a given city and display their phone numbers.
4.	Use SQL operators to find parts within a specific price range (200–500).
5.	Perform an INNER JOIN between Supplier and Supplies to display supplier names with supplied quantities.
6.	Compare and retrieve distinct branches and analyze how many suppliers belong to each branch.

7.	Write queries using GROUP BY and HAVING to identify branches with more than 2 suppliers.
8.	Analyze Supplier data to find patterns using LIKE operator (e.g., names starting/ending with specific letters).
9.	Differentiate results obtained from INNER JOIN vs LEFT JOIN on Supplier and Supplies tables.
10.	Examine part data to determine max, min, and average prices, and interpret differences.
11.	Evaluate which suppliers are most active by analyzing quantity supplied and justify your result.
12.	Compare different SQL queries (JOIN vs sub query) to retrieve the same data and determine which is more efficient.
13.	Assess the impact of updating all supplier cities to "Mumbai" on data consistency.
14.	Judge whether normalization is required in the given schema and justify your reasoning.
15.	Evaluate which constraints (PRIMARY KEY, UNIQUE, CHECK) are most critical for maintaining data integrity in the tables.
16.	Design an ER diagram for Supplier-Part-Supplies system and convert it into relational tables.
17.	Develop a PL/SQL procedure to update supplier details based on input parameters.
18.	Create a trigger that automatically logs changes when part prices are updated.
19.	Design a query to find suppliers who supplied both red and green parts using set operations.
20.	Build a small database system (schema + queries) to manage suppliers and parts, including constraints, joins, and reports.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Useful Video links:

Experiment name	Links
Use SQL operators to find parts within a specific price range (200–500).	https://youtu.be/lDtl3xN-wm8?si=6CK1VWPdnmy3FScc
Compare different SQL queries (JOIN vs sub query) to retrieve the same data and determine which is more efficient.	https://youtu.be/TB5T2O8Hwm8?si=LmkIX22b_j1cT0Bp
Analyze Supplier data to find patterns using LIKE operator (e.g., names starting/ending with specific letters).	https://youtu.be/lDtl3xN-wm8?si=UotC1F4Qdd1HxgnY
Design an ER diagram for Supplier-Part-Supplies system and convert it into relational tables.	https://youtu.be/5TU7zH0Z8ps?si=vSsEkntFkE1ge0E-

Course Code	**CC-BCA-207B**				
Category	**Core Courses**				
Course Title	**Software Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • Understand software engineering concepts, process models, and agile methodologies. • Learn requirements engineering, risk management, design, testing, and project planning techniques. • Gain knowledge of software quality, metrics, release management, and maintenance strategies.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define software engineering concepts, process models, agile methods, requirements, design, testing, and quality management.	Level-1 Remember
CO2	Explain software development processes including requirements engineering, risk management, design, testing, and maintenance strategies.	Level-2 Understand
CO3	Apply software engineering techniques to develop requirements specifications, design models, and testing strategies.	Level-3 Apply
CO4	Analyze software processes, design structures, risk factors, and quality metrics for effective software development.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum,A Tool Set for the Agile Process.

Unit-II

Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.
Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.

Unit-III

Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.
Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT -IV

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.
Release Management: Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring.
Product sustenance: Maintenance, updates, End of life, migration strategies.

Suggested Readings:

- Software Engineering, N.S. Gill, Khanna Publishing House 2023 (AICTE Recommended Textbook)
- Software Engineering, I an Somerville, 9th edition, Pearson education.
- Software EngineeringApractitioner's Approach, 8th edition, Roger SPressman, Bruce R.Maxim.McGrawHill Education,2015.
- Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007 2. Software Engineering: Principles and Practice Hans van Vliet
- https://nptel.ac.in/courses/106101061

Useful Video links

Unit No.	Topics	Links
1	**Software Engineering**	https://nptel.ac.in/curses/106101061
2	**Software Requirements**	https://nptel.ac.in/courses/106105087
3	**Design & Testing Strategies**	https://nptel.ac.in/courses/106105182
4	**Quality Management**	https://nptel.ac.in/courses/106101061

Course Code	**SEC-BCA-201B**				
Category	**Skill Enhancement Courses**				
Course Title	**Python Programming**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	2	0	0	**2**	
Course Objectives	The objectives of this course are to • Understand the basics of Python programming, including syntax, data types, strings, and control structures. • Learn to use functions, modules, data structures, file handling, and exception handling in Python. • Gain knowledge of data visualization and working with libraries like NumPy for data processing.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define Python programming concepts including syntax, data types, control structures, and functions.	Level-1 Remember
CO2	Explain strings, control flow, functions, data structures, file handling, and exception handling in Python.	Level-2 Understand
CO3	Apply Python programming constructs such as loops, functions, lists, files, and modules to solve problems.	Level-3 Apply
CO4	Analyze Python programs involving data structures, file operations, exception handling, and data visualization techniques.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: History and Application areas of Python ; Structure of Python Program; Identifiersand Keywords; Operators and Precedence; Basic Data Types and type conversion; Statements and expressions; Input/Output statements.

Strings: Creating and Storing Strings, Built-in functions for strings; string operators, String slicing and joining; Formatting Strings.

Unit -II

Control Flow Statements: Conditional Flow statements; Loop Control Statements; Nested control Flow; continue and break statements, continue, Pass and exit.

Functions: Built-In Functions, Function Definition and call; Scope and Life time of Variables, Default Parameters, Command Line Arguments; Lambda Functions; Assert statement; Importing User defined module.

Unit -III

Mutable and Immutable objects: Lists, Tuples and Dictionaries; Commonly used Functions on Lists, Tuples and Dictionaries. Passing Lists,tuples and Dictionaries as arguments to functions. Using Math and Numpy module for list of integers and arrays.

Files: Types of Files; Creating, Reading and writing on Text and Binary Files; The Pickle Module, Reading and Writing CSV Files. Reading and writing of csv and JSON files.

UNIT- IV

Exception Handling: Try-except-else-finally block, raise statement, hierarchy of exceptions, adding exceptions.
Data visualization: Plotting various 2D and 3D graphics; Histogram; Pi charts; Sine and cosine curves.

Suggested Readings:

- Venkatesh ,NagarajuY ,Introductio intoPython Programming, Khanna Publishing House, 2021.
- Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, Khanna Publishing House, 2023.
- Sheetal Taneja & Naveen kumar: Python Programming a Modular approach–A Modular approach with Graphics, Database, Mobile and Web applications, Pearson, 2017.
- Think Python, by AllenDowney, 2nd edition, 2015, O'Reilly. https://drive.google.com/file/d/1p9Pul6d5UvnQrO9-Q- LE2_p4YvMk5cIg/view
- An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.
- Introduction to Computation and Programming using Python, by John Guttag, 2nd edition, 2016, PHI India.

Useful Video links:

Unit No.	Topics	Links
1	**Python Programming**	https://nptel.ac.in/courses/106106145
2	**Control Flow Statements**	https://nptel.ac.in/courses/103105782
3	**Mutable and Immutable objects**	https://nptel.ac.in/courses/115104095
4	**Exception Handling**	https://nptel.ac.in/courses/106106212

Course Code	**LC-BCA-209B**				
Category	**Skill Enhancement Courses**				
Course Title	**Python Programming Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • Understand and implement basic Python programming concepts including control structures, functions, and data structures. • Apply Python programming for problem solving using strings, files, NumPy, and exception handling. • Develop programs for data processing and visualization using Python libraries and built-in functions.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply Python programming concepts to solve problems involving control structures, functions, strings, and data structures.	Level-3 Apply
CO2	Analyze program requirements involving NumPy operations, file handling, and exception handling to design efficient solutions.	Level-4 Analyze
CO3	Evaluate different Python implementations for string manipulation, array processing, and data visualization techniques.	Level-5 Evaluate
CO4	Create Python programs and modules to implement real-world applications using functions, file operations, and graphical data representation.	Level-6 Create

List of Experiments:

Exp. No.	Contents
1.	Write a program to find whether a number is a prime number.
2.	Write a program to print m raise to power n, where m and n are read from the user.
3.	Write a program having a parameterised function that returns True or False depending on whether the parameter passed is even or odd.
4.	Write a program to print the summation of the following series upto n terms: 1-2+3-4+5- 6+7…n
5.	Write a menu driven program to perform the following operations on strings using string built in functions. a) Find the frequency of a character in a string. b) Replace a character by another character in a string. c) Remove the first occurrence of a character from a string. d) Remove all occurrences of a character from a string.

6.	Write A program that Accepts two strings and returns the in dices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1
7.	Using Numpy module write menu driven program to do following a) Create an array filled with1's. b) Find maximum and minimum values from an array c) Dot product of 2 arrays. d) Re shape a 1-D array to 2-D array.
8.	Write a function that takes as entence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.
9.	Consider at up let 1= (1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations : a) Print contents of t 1 in 2 separate lines such that half values come on one line and other half in the next line. b) Print all even values of t 1as another t up let 2. c) Concatenate triplet 2= (11,13,15) with t 1. d) Return maximum and minimum value from t1..
10.	Write a function that reads a file file1 and copies only alternative lines to another file file2. Alternative lines copied should be the odd numbered lines.
11.	Write a Python program to handle a Zero Division Error exception when dividing a number by zero.
12.	Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
13.	Write a program that makes use of a function to display sine, cosine, polynomial and exponential curves.
14.	Take as input in the months and profits made by a company ABC over a year. Represent this data using a line plot. Generated line plot must include X axis label name = Month Number and Y axis label name = Total profit.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Useful Video links:

Experiment Name	**Links**
Write a program to print the summation of the following series upto n terms: 1-2+3-4+5- 6+7…n	https://nptel.ac.in/courses/106106145
Write a program to find whether a number is a prime number.	https://nptel.ac.in/courses/103105782
Write a function that takes as entence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.	https://nptel.ac.in/courses/115104095
Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates.	https://nptel.ac.in/courses/106106212

Course Code	**VAC-201B**				
Category	Value Added Courses				
Course Title	**Disaster Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are 1. To understand the concepts of disasters, hazards, risks, and vulnerabilities. 2. To understand various natural and man-made disasters and their impacts. 3. To understand disaster management strategies, including planning, response, and recovery. 4. To understand the relationship between development, climate change, and disaster risk reduction.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** key concepts of disasters, man-made disaster, disaster management, and their link to development and vulnerability.	Level-1 Remember
CO2	**Describe** the disaster types, impacts, disaster management phases, disaster risk reduction strategies, policies, legislation, and emergency response mechanisms	Level-2 Understand
CO3	**Apply** the disaster management practices, preparedness planning, risk reduction measures, and emergency response techniques in disasters and crises.	Level-3 Apply
CO4	**Analyze** disaster risks, vulnerabilities, management strategies, policies, and emergencies to support effective disaster preparedness and recovery.	Level-4 Analyze

Note:

1. All the theoretical contents shall be delivered through the practical workshopmode only. No classroomteaching isencouraged in this course. The list of experiments may be designed by the course coordinator in consultation with the Head of Department.
2. Training and Demonstration Workshops (at least two workshops) be organized inassociation with the NIDM, NDRF, NCDC, Paramilitary, Fire Brigade, CISF, localadministration etc.

Unit I

Concepts and Terminologies: Understanding key concepts of Hazards, disasters; Disaster types and causes(Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made);Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmentaland Psychosocial); Defining Vulnerability (Physical Vulnerability; EconomicVulnerability; Social Vulnerability).

Unit II

Key concepts of Disaster Management Cycle: Components of disaster management cycle (Phases: Response and recovery, Riskassessment, Mitigation and prevention, Preparedness planning, Prediction and warning);Disaster risk reduction (DRR), Community-based disaster risk reduction.

Unit III

Initiatives at the National and International level: Disaster Risk Management in India and at the international level: Related policies, plans,programmes and legislation; International strategy for disaster reduction and otherinitiatives.

Unit IV

Emergency Management: Explosion and accidents (Industrial, Nuclear, Transport and Mining) - Spill (Oil andHazardous material); Threats (Bomb and terrorist attacks) - Stampede and conflicts

E-Resources

- http://www.ndma.gov.in/en/
- http://nidm.gov.in/
- https://www.unisdr.org/
- http://www.emdat.be
- https://www.weather.gov/safety/
- https://www.preventionweb.net/risk/vulnerability

Useful Video Links:

UnitNo.	Topics	Links
Unit-I	Concept of Hazard	https://nptel.ac.in/courses/105104183
Unit-II	Disaster risk reduction (DRR)	http://acl.digimat.in/nptel/courses/video/124107010/L11.html
Unit-III	Disaster Risk Management	https://youtu.be/D7CRK7wMamo?si=C_f-j-Lm8g1WgmDa
Unit-IV	Condensed Phase Explosives and their Properties	http://digimat.in/nptel/courses/video/112106177/L34.html

Course Code	**VAC-203B**				
Category	Value Added Courses				
Course Title	**Yoga and Physical Fitness**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • Understand the concepts of yoga, physical fitness, and their importance for a healthy lifestyle. • Learn various yogic practices, physical activities, and wellness components for overall development. • Gain knowledge of nutrition, weight management and factors affecting physical and mental well-being.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of yoga, physical fitness, wellness, and nutrition.	Level-1 Remember
CO2	Explain yogic practices, physical activities, wellness components, and weight management principles.	Level-2 Understand
CO3	Apply yoga techniques, physical exercises, and wellness practices for healthy lifestyle development.	Level-3 Apply
CO4	Analyze the impact of yoga, fitness activities, wellness factors, and nutrition on physical and mental health.	Level-4 Analyze

Note:

- All the theoretical contents shall be delivered through the practical workshop mode only. No class room teaching is encouraged in this course.
- The list of experiments may be designed by the course coordinator in consultation with the Head of Department.

Unit-I

Yoga: Meaning and definition, Importance of yoga in 21st century, Introduction to Yogic Anatomy and Physiology, Yoga & sports, Yoga for healthy lifestyle,
Types of Yoga: Hathayoga, layayoga, mantrayoga, bhaktiyoga, karmayoga, jnanayoga, raj yoga, Study of Chakras, Koshas, Pranas, Nadis, Gunas, Vayus and its application in Yogic practices.
Ashtang Yoga: Yama, niyama, asana, pranayama, Pratyahar, dharna, dhyan, Samadhi: Benefits, Utilities & their psychological impact on body and mind. According to yoga concept of normality in modern psychology, concept of personality & its development, yogic management of psycho-somatic ailments: frustration, anxiety, depression

Unit- II

Sports for Physical Fitness: Meaning and definition, Physical Activity– Concept, Benefits of Participation in Physical Activities,Components and Significance of Physical Fitness- Health, Skill and Cosmetic Fitness.

Types of Physical Activities–Walking, Jogging, Running, Calisthenics, Rope Skipping, Cycling, Swimming, Circuit Training, Weight training, Adventure Sports, Principles of Physical Fitness, Warming Up, Conditioning, Cooling Down, Methods to Develop and Measure Health and Skill related components of Physical Fitness, Measurement of Health Related Physical Fitness (HRPF)

Unit-III

Physical Wellness: Concept, Components, Types of wellness: psychological, social, emotional, and spiritual.Significance with reference to Positive Lifestyle 2.2,Concepts of Quality of Life and Body Image, Factors affecting Wellness,Wellness Programmes

Unit-IV

Nutrition and Weight Management: Concept of Nutrients, Nutrition, Balanced Diet, Dietary Aids and Gimmicks**,**Energy and Activity- Calorie Intake, Energy Balance Equation**,**Obesity- Concept, Causes, Obesity Related Health Problems**,**Weight Management through Behavioural Modifications

Suggested Readings:

- Anand OP. Yog Dawra Kaya Kalp. Sewasth Sahitya Perkashan. Kanpur.
- Brown, J.E. Nutrition Now Thomson-Wadsworth.
- Corbinet. al. Fitness & Wellness- Concepts. McGraw Hill. Publishers. New York. U.S.A
- Corbin, C.B., G.J. Welk, W.R Corbin, K.A. Welk, Concepts of Physical Fitness: Active Lifestyle for Wellness. McGraw Hill, New York, USA.
- Hoeger, WWK and S.A. Hoeger. Principles and Labs for Fitness and Wellness, Thomson Wadsworth, California, USA.
- Hoeger, W.W. & S. Hoeger Fitness and Wellness. 7th Ed. Thomson Wadsworth, Boston, USA.
- Kamlesh, M.L. & Singh, M. K.) Physical Education(Naveen Publications).
- Kansal, D.K. Text book of Applied Measurement, Evaluation & Sports Selection. Sports & Spiritual Science Publications, New Delhi.
- Kumari, Sheela, S., Rana, Amita, and Kaushik, Seema,, Fitness, Aerobics and Gym Operations, Khel Sahitya, New Delhi
- Lumpkin, A. Introduction to Physical Education, Exercise Science and Sports Studies, McGraw Hill, New York, U.S.A.
- Savard, M. and C. Svec The Body Shape Solution to Weight Loss and Wellness: The Apples & Pears Approach to Losing Weight, Living Longer, and Feeling Healthier. Atria Books, Sydney, Australia.
- Sri Swami Ramas. Breathing. Sadhana Mandir Trust. Rishikesh.
- Swami Ram Yoga & Married Life Sadhana Mandir Trust. Rishikesh

Useful Video links

Unit No.	Topics	Links
1	**Types of Yoga**	https://youtu.be/wQ8CgB5WURk?si=mhM-bI0ixJbffSHR
2	**Sports for Physical Fitness**	https://youtu.be/8vK7cUj1cyI?si=VDUq1tYMthZG8abr
3	**Physical Wellness**	https://nptel.ac.in/courses/110101165
4	**Nutrition and Weight Management**	https://youtu.be/vjoeaQlooV4?si=ggo5afV6uOSYorsS

Course Code	**VAC-205B**				
Category	Value Added Courses				
Course Title	**Sports Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • Understand the fundamentals of sports management, its structure, governance, and ethical issues. • Learn sports marketing, sponsorship, financial management, and event management concepts. • Gain knowledge of sports analytics, technology, and their applications in performance and fan engagement.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of sports management, marketing, finance, and sports analytics.	Level-1 Remember
CO2	Explain sports organizational structures, marketing strategies, financial systems, and analytics applications.	Level-2 Understand
CO3	Apply sports management principles in marketing, sponsorship, financial planning, and event management.	Level-3 Apply
CO4	Analyze sports organizations, marketing strategies, financial models, and performance data using analytics tools.	Level-4 Analyze

Note:

- All the theoretical contents shall be delivered through the practical workshop mode only. No class room teaching is encouraged in this course.
- The list of experiments may be designed by the course coordinator in consultation with the Head of Department.

Unit-I

Introduction to Sports Management: Definition and scope of sports management, Significance of sports management in society and its evolution over time, Organizational structure of sports: amateur, professional, and non-profit entities, Roles and responsibilities of key personnel: managers, coaches, and agents, Governance bodies in sports: FIFA, IOC, and NCAA, Legal issues: contracts, negotiations, intellectual property rights, Ethical considerations: fair play and doping.

Unit -II

Sports Marketing and Sponsorship: Unique aspects of sports marketing, Fan engagement strategies, Target audience identification and segmentation, Branding strategies for sports teams and athletes, Sponsorship and endorsement deals, Negotiating and managing partnerships,
Event management: planning, organizing, and promoting sports events

Unit -III

Financial Management in Sports: Revenue generation in sports: ticket sales, broadcasting rights, merchandise sales, Financial models: budgeting and forecasting, Cost management: player salaries, facility expenses, operational costs, Investment opportunities in sports, Risk management techniques specific to sports organizations.

Unit -IV

Sports Analytics and Technology: Introduction to sports analytics, Evaluating player performance, Devising game strategies, Fan engagement through technology, Analytical techniques: statistical analysis, data visualization, predictive modeling, Key performance indicators (KPIs) in sports, Applications of analytics: talent scouting, injury prevention, performance optimization.

Suggested Readings:

- Pedersen, P.M., Thibault, L., & Pedersen, P.M. (2019). Contemporary Sport Management. Human Kinetics.
- Hoye, R., Smith, A.C.T., Nicholson, M., et al. (2021). Sports Management: Principles and Applications. Routledge.
- Chelladurai, P., & Kerwin, S. (2017). Introduction to Sport Management: Theory and Practice. Human Kinetics.
- Hoye, R., Cuskelly, G., & Nicholson, M. (2019). Sports Governance: A Guide for Sport Organizations. Routledge.
- Conrad, M. (2018). The Business of Sports: A Primer for Journalists. Routledge.
- Shank, M.D. (2019). Sports Marketing: A Strategic Perspective. Pearson.
- Collett, P., & Fenton, W. (2019). The Sponsorship Handbook: Essential Tools, Tips and Techniques for Sponsors and Sponsorship Seekers. Kogan Page.
- Fullerton, S. Jr., & Funk, D.C. (2019). Sports Marketing: A Practical Approach. Routledge.
- Conrad, M. (2019). Winning in Sports Business: Essential Marketing, Finance, and Management Strategies. Routledge.
- McCarty, L.A., & McPherson, G. (2019). Sports Event Management: The Caribbean Experience. Routledge.
- Brown, M.T., Rascher, D., & Leeds, M.A. (2017). Financial Management in the Sport Industry. Routledge.
- Winfree, J.A., & Rosentraub, M.S. (2017). Sports Finance and Management: Real Estate, Entertainment, and the Remaking of the Business. Taylor & Francis.

- Foster, G., O'Reilly, N., & Cuskelly, G. (2018). Sports Business Management: Decision Making Around the Globe. Routledge.
- Brown, M.T., & Shick, D.M. (2019). Financial Management in the Sport Industry. Routledge.
- Conrad, M. (2018). The Business of Sports: A Primer for Journalists. Routledge.
- Alamar, B.C. (2013). Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers. Columbia University Press.
- Miller, T.W. (2019). Sports Analytics and Data Science: Winning the Game with Methods and Models. FT Press.
- Marchi, M., Albert, J., & Baumer, B. (2014). Analyzing Baseball Data with R. Chapman and Hall/CRC.
- Schumaker, R.P., Hwang, R.S.Y., & Chen, H. (2016). Sports Data Mining. Routledge.
- Alamar, B.C. (2013). Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers. Columbia University Press.

Useful Video links:

Unit No.	Topics	Links
1	**Sports Management**	https://nptel.ac.in/courses/109105596
2	**Branding strategies for sports teams and athletes**	https://nptel.ac.in/courses/109106403
3	**Risk management techniques**	https://nptel.ac.in/courses/109106645
4	**Sports Analytics and Technology**	https://nptel.ac.in/courses/109106407

Discipline Specific Elective Course (BCA)

Course Code	**DSE-BCA-201B**				
Category	Discipline Specific Elective Courses				
Course Title	**Computer Graphics**				
Scheme and Credits	L	T	P	**Credits**	**Semester III**
	1	0	0	**1**	
Course Objectives	The objectives of this course are • To understand the core concepts, mathematical foundations, and algorithms used in 2D and 3D computer graphics. • To explore various techniques including transformations, clipping, shading, and rendering to create and manipulate graphical content.				
Assessment	05 Marks				
End Semester Examination	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamentals of computer graphics, graphics pipeline, primitives, and coordinate systems.	Level 1: Remember
CO2	Explain 2D graphics concepts, drawing algorithms, transformations, and window–viewport techniques.	Level 2: Understand
CO3	Apply clipping, basic 3D transformations, and projection techniques.	Level 3: Apply
CO4	Analyze lighting, shading, hidden surface removal, and texture mapping techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts of 1 mark each from all units and remaining 8 questions of 4 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Computer Graphics, its applications and importance, raster and vector graphics, graphics pipeline and rendering process, graphics primitives, and basic coordinate systems.

Unit-II

Fundamentals of 2D graphics including pixel operations, RGB color model, line drawing algorithms (DDA and Bresenham), basic 2D transformations (translation, rotation, and scaling), and concepts of window and viewport.

Unit-III

Introduction to clipping techniques with Cohen–Sutherland line clipping algorithm, fundamentals of 3D graphics, basic 3D transformations, and projection techniques including orthographic and perspective projection.

Unit-IV

Basics of lighting and shading, hidden surface removal using the Z-buffer algorithm, and introduction to texture mapping and image rendering techniques.

Suggested Readings:

- J. F. Hughes, A. van Dam, M. McGuire, D. F. Sklar, and J. D. Foley: Computer Graphics: Principles and Practice, Addison-Wesley.
- D. Shreiner, G. Sellers, J. M. Kessenich, and B. M. Licea-Kane: OpenGL Programming Guide: The Official Guide to Learning OpenGL, Addison-Wesley.
- D. Hearn and M. P. Baker: Computer Graphics with OpenGL, Pearson.
- E. Angel and D. Shreiner: Interactive Computer Graphics: A Top-Down Approach with WebGL, Addison-Wesley.
- F. Klawonn: Introduction to Computer Graphics: Using Java 2D and 3D, Springer.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Computer Graphics	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19cs34/lec1.html
	Raster Graphics	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19cs34/lec2.html
Unit-II	2D Transformations	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19cs34/lec6.html
	Composite Transformations	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19cs34/lec7.html
Unit-III	Clipping	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19cs34/lec8.html
	Polygon Clipping	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19cs34/lec9.html
Unit-IV	Illumination Models	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19cs34/lec17.html
	Shading Techniques	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19cs34/lec18.html

Course Code	**LC-BCA-211B**				
Category	Discipline Specific Elective Courses				
Course Title	**Computer Graphics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are • To develop a foundational understanding of 2D graphics concepts and algorithms such as line and circle drawing, transformations, and clipping techniques. • To enable students to apply and implement computer graphics algorithms for visualizing geometric transformations, object rendering, and graphical manipulations using programming.				
Assessment	15 Marks				
End Semester Examination	35Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply basic computer graphics algorithms such as DDA, Bresenham's line and circle drawing to construct and render 2D primitives.	Level 3: Apply
CO2	Implement 2D geometric transformations such as translation, rotation, scaling, reflection, and shearing on graphical objects.	Level 4: Analyze
CO3	Analyze and compare different line and polygon clipping algorithms, and implement solutions to clip graphics primitives within a defined window.	Level 5 Evaluate
CO4	Evaluate the effect of various transformations and coloring techniques in rendering graphical scenes.	Level 6 Create

List of Experiments:

Exp. no.	Contents
1.	Implement a program to define and use basic graphics primitives such as points, lines, and polygons.
2.	Implement a program to draw a line using the Digital Differential Analyzer (DDA) algorithm.
3.	Create a program to draw a line using Bresenham's line drawing algorithm.
4.	Write a program to draw a circle using the Midpoint Circle algorithm.
5.	Implement a program to draw a circle using Bresenham's circle drawing algorithm.
6.	Create a program to perform 2D transformations: translation, rotation, and scaling on a given set of points.
7.	Write a program to perform mirror reflection of a 2D shape across the x-axis and y-axis.

8.	Create a program to draw basic two-dimensional objects like rectangles, triangles, and polygons using inbuilt functions
9.	Write a program to implement the Cohen-Sutherland line clipping algorithm to clip a line within a rectangular clipping window.
10.	Write a program to apply a shearing transformation to a 2D object (like a square or triangle) and display the original and transformed objects
11.	Write a program to apply various coloring techniques to 2D pictures..
12.	Write a program to implement line clipping using the Cohen-Sutherland line clipping algorithm

Discipline Specific Elective Course (BCA- Data Science)

Course Code	**DSE-BCA-DS-201B**				
Category	**Discipline Specific Elective**				
Course Title	**Basics of Data Analytics using Spreadsheet**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	1	0	0	**1**	
Course Objectives	The objectives of this course are • To understand the fundamental concepts of data analytics, including types of data and analytical approaches. • To understand the importance and applications of data analytics across various domains and industries. • To understand data collection, preprocessing techniques, and ethical considerations in data analytics.				
Assessment	05Marks				
End Semester Examination	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define concepts of data, types, analytics processes, data handling methods, ethics, and industry applications.	Level-1 Remember
CO2	Explain data types, analytics techniques, data preparation steps, ethical issues, and real-world applications across industries.	Level-2 Understand
CO3	Apply data analytics methods including data collection, cleaning, transformation, and interpretation in practical scenarios.	Level-3 Apply
CO4	Analyze datasets and case studies to evaluate data types, preprocessing methods, ethical considerations, and industry-specific outcomes.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts of 1 mark each from all units and remaining 8 questions of 4 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Data Analytics

Understanding data and its types (structured, unstructured, semi-structured)-What is Data Analytics- Types of data Analytics

Unit-II

Importance and Applications

Importance of Data Analytics- Applications of Data Analytics.

Unit-III

Data- Ethics

Data Collection Methods - Different Data Sources & format - Data Cleaning and Transformation - Handling Missing Data and Outliers. - Ethical considerations in data analytics.

Unit-IV

Applications in Industry-Case Studies

Real-world Applications of Data Analytics- Industry-specific applications (finance, marketing, operations) - Case Study

Note: **Case study is for discussion not to be considered for evaluation.**

Reference Books :

- "Excel 2019 Bible" by Michael Alexander, Richard Kusleika, and John Walkenbach,
- John Wiley & Sons, 25 Sept 2018
- "Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics" by Cliff T Ragsdale, Cegage learning asia pet. 2015
- "Mastering Excel" by WebTech Solutions, Khanna Publishing House, 2024.

Video Links

Topics	Links
Data Analytics	https://nptel.ac.in/courses/106107220
Importance of Data Analytics	https://nptel.ac.in/courses/106101224
Data Cleaning	https://nptel.ac.in/courses/110104513
Industry-specific applications (finance, marketing,operations)	https://nptel.ac.in/courses/110103917

Course Code	**LC-BCA-DS-203B**				
Category	**Discipline Specific Elective**				
Course Title	**Basics of Data Analytics using Spreadsheet Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are • To understand the fundamental features of Excel, including data entry, formatting, functions, and cell referencing. • To understand data import, cleaning, transformation techniques, and basic statistical analysis using Excel tools. • To understand data visualization, PivotTables, and dashboard creation techniques for effective data analysis and presentation.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply Excel functions and formulas for data entry, calculation, and basic analysis.	Level-3 Apply
CO2	Analyze datasets using data cleaning, transformation techniques, and statistical tools in Excel.	Level-4 Analyze
CO3	Evaluate data using visualization methods and advanced charting techniques to derive insights.	Level-5 Evaluate
CO4	Create interactive dashboards using PivotTables, Pivot Charts, and conditional formatting.	Level-6 Create

List of Experiments:

EXP. No.	Experiments
1	Getting started with Excel: Workbook, Worksheet, Cells, and Ranges
2	Data entry and basic formatting techniques
3	Using basic arithmetic functions: SUM, AVERAGE, MIN, MAX, ROUND
4	Introduction to cell referencing: relative, absolute, and mixed
5	Importing data from various sources (CSV, text files, web data)
6	Data cleaning: removing duplicates, handling missing data, and standardizing formats
7	Data transformation: text-to-columns, data validation techniques
8	Using the "Find & Replace" and "Text Functions" (LEFT, RIGHT, MID,
9	Calculating measures of central tendency: mean, median, mode
10	Computing measures of dispersion: range, variance, standard deviation
11	Creating and interpreting frequency distributions and histograms
12	Using Excel's "Data Analysis Toolpak" for basic statistical analysis
13	Using logical functions: IF
14	Lookup and reference functions: VLOOKUP

15	Data aggregation techniques: SUMIFS
16	Text functions for data manipulation: TRIM
17	Creating various chart types: bar, line, pie, scatter
18	Advanced charting techniques: combo charts, dual-axis charts
19	Data visualization best practices: choosing the right chart, formatting, and styling
20	Creating and customizing PivotTables and Pivot Charts
21	Introduction to dashboards: concepts and components
22	Using PivotTables and Pivot Charts for dashboard elements
23	Applying conditional formatting for dynamic visual cues 4. Creating interactive dashboards with slicers and timeline

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Discipline Specific Elective Course (BCA- AIML)

Course Code	**DSE-BCA-AIML-201B**				
Category	**Discipline Specific Elective**				
Course Title	**Feature Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	1	0	0	**1**	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts of data, features, and feature engineering in machine learning. • To understand data preprocessing techniques including cleaning, transformation, encoding, and scaling methods. • To understand feature engineering techniques such as feature selection, extraction, and dimensionality reduction.				
Assessment	05Marks				
End Semester Examination	20 Marks				
Total	25Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of data, features, and feature engineering techniques including preprocessing and feature selection methods.	Level-1 Remember
CO2	Explain types of features, preprocessing steps, and feature engineering techniques for numerical and categorical data.	Level-2 Understand
CO3	Apply feature engineering techniques such as scaling, encoding, transformation, and feature extraction on datasets.	Level-3 Apply
CO4	Analyze datasets using feature selection and dimensionality reduction techniques such as filter methods and PCA.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts of 1 mark each from all units and remaining 8 questions of 4 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit- I

Introduction to Feature Engineering

Introduction to Data and Features: Importance of Features in Machine Learning. Data types and features: Numerical, Categorical, Ordinal, Discrete, Continuous, Interval and Ratio.

Unit- II

Basic Feature Engineering

Basic Feature Preprocessing: Handling Missing Data, Data Cleaning, Feature Scaling, Normalization, and Transformation.

Unit -III

Feature Engineering Techniques I

Techniques for Numerical Data: Binning and Discretization, Polynomial and Interaction Features. Categorical Data Techniques: One Hot Encoding, Label Encoding.

Unit- IV

Feature Engineering Techniques II

Feature extraction vs. feature selection, Steps in feature selection. Feature Selection Methods: Filter, Wrapper, and Hybrid. Feature Reduction: Introduction and application of Principal Components Analysis.

Suggested Readings:

- M.C. Trivedi, Data Science and Data Analytics Using Python Programming, Khanna Publishing House, 2024.
- Zheng, Alice, & Casari, Amanda. (2018). Feature engineering for machine learning: Principles and techniques for data scientists. O'Reilly Media, Inc.
- Kalita, J. K., Bhattacharyya, D. K., & Roy, S. (2023). Fundamentals of Data Science: Theory and Practice. Elsevier. ISBN-13: 9780323917780.

Reference Books:

- Duda, R. O., Hart, P. E., Stork, D (2007). Pattern classification (2Ed), John Wiley & Sons, ISBN-13: 978-8126511167.
- N. Bhaskar, Vasundhara, Machine Learning, Khanna Publishing House, 2024.
- M.C. Trivedi, Deep Learning and Neural Network_MC Trivedi, Khanna Publishing House, 2024.
- Ng, Andrew. (2018). Machine learning yearning (Draft, MIT Licensed). GitHub. ISBN- 10: 199957950X, ISBN-13: 978-1999579500.
- Han, Jiawei, Kamber, Micheline, & Pei, Jian. (2011). Data mining: Concepts and techniques (3rd ed.). Morgan Kaufmann Publishers. ISBN 978-0123814791.
- Tan, Pang-Ning, Steinbach, Michael, Karpatne, Anuj, & Kumar, Vipin. (2021). Introduction to data mining (2nd ed.). Pearson. ISBN 978-9354491047.
- Provost, Foster, & Fawcett, Tom. (2013). Data science for business: What you need to know about data mining and data-analytic thinking. O'Reilly Media, Inc.
- Galli, Soledad. (2020). Python feature engineering cookbook: Over 70 recipes for creating, engineering, and transforming features to build machine learning models. Packt Publishing, Limited.
- Nielsen, Aileen. (2019). Practical time series analysis: Prediction with statistics and machine learning. O'Reilly Media.
- Rajiv Chopra, Deep Learning, Khanna Publishing House, 2024.
- Jeeva Jose, Machine Learning, Khanna Publishing House, 2024.
- Chollet, François. (2017). Deep learning with Python. Manning Publications. ISBN 9781617294433.

Course Code	**LC-BCA-AIML-203B**				
Category	**Discipline Specific Elective**				
Course Title	**Feature Engineering Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • Apply data preprocessing techniques such as handling missing values, cleaning invalid data, scaling numerical features, and encoding categorical variables. • Analyze and explore datasets using visualization methods, correlation analysis, and time-series decomposition to understand data patterns and relationships. • Develop and implement advanced data transformation methods including feature engineering, text processing, image augmentation, and dimensionality reduction.				
Assessment	15Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Apply** data preprocessing and feature engineering techniques including missing value handling, data cleaning, scaling, normalization, encoding, transformation, and text and image processing.	Level-3 Apply
CO2	**Analyze** datasets using exploratory data analysis, correlation analysis, feature transformation, time series decomposition, and dimensionality reduction techniques.	Level-4 Analyze
CO3	**Evaluate** feature engineering and data representation methods including binning, polynomial features, TF-IDF, Bag-of-Words, image augmentation, and PCA.	Level-5 Evaluate
CO4	**Design** data preprocessing and feature engineering pipelines for structured, unstructured, image, and time-series data to improve model performance.	Level-6 Create

List of Experiments:

Exp No.	Contents
1.	Handle missing values in column(s) of a dataset. For example, fill missing values with the mean/median/mode of the columns such as ‘Age’, ‘Height’, ‘Weight’, ‘Grade’ for a dataset.

2.	Clean a dataset by identifying and removing invalid data entries. For example, a dataset having columns 'Name', ‘Gender’ and 'Age' where 'Name' contains 'invalid data'.
3.	Scale numerical features using Min-Max normalization for a dataset with columns like ‘Height', ‘Weight’.
4.	Perform exploratory data analysis and visualize data distributions using histograms and boxplots.
5.	Compute and visualize the correlation matrix of a dataset with 2 or more columns.
6.	Bin numerical data into discrete intervals for a dataset with a column containing numerical values.
7.	Create polynomial and interaction features from numerical data in a dataset with two columns.
8.	Apply logarithmic transformation to skewed numerical features in a dataset with column 'Distance'.
9.	Perform one-hot encoding on categorical features in a dataset with column 'Category' containing categorical values. The distinct values in the Category feature are [Good, Better, Best] and Gender [Male, Female].
10.	Preprocess text data (tokenization) for a dataset with a column 'Text'.
11.	Preprocess text data (stemming) for a dataset with a column 'Text'.
12.	Preprocess text data (lemmatization) for a dataset with a column 'Text'.
13.	Convert text data into a Bag-of-Words representation for a dataset with a column 'Text'.
14.	Apply TF-IDF transformation to text data for a column 'Text'.
15.	Perform image augmentation (resizing, normalization, rotation, translation) for a set of images.
16.	Perform image augmentation resizing for a set of images.
17.	Perform image augmentation normalization for a set of images.
18.	Perform image augmentation rotation for a set of images.
19.	Perform image augmentation translation for a set of images.
20.	Decompose a time series into trend, seasonal, and residual components for a dataset with a column 'TimeSeries'.
21.	Perform Principal Component Analysis (PCA) on a dataset and visualize the first two principal components.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

SEMESTER –IV

(Syllabi of Common Courses for all streams)

Course Code	**CC-BCA-202B**				
Category	**Core Courses**				
Course Title	**Entrepreneurship and Startup Ecosystem**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	1	1	0	**2**	
Course Objectives	The objectives of this course are to ● To understand the concept of entrepreneurship, characteristics of entrepreneurs, and the role of family businesses in economic development. ● To evaluate business opportunities through idea generation, market assessment, and feasibility analysis. ● To develop knowledge of essential components required for starting and managing a new venture, including marketing, team building, funding, and legal aspects, along with the start-up ecosystem and funding sources in India.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** the concepts, characteristics, classifications of entrepreneurs, and features of family businesses.	Level-1 Remember
CO2	**Explain** the process of identifying and evaluating business opportunities, including market potential and feasibility analysis.	Level-2 Understand
CO3	**Apply** the key building blocks required for starting ventures, including marketing, team building, funding, and legal aspects.	Level-3 Apply
CO4	**Analyze** the components of the start-up ecosystem, government schemes, and sources of venture funding in India.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Introduction to Entrepreneurship & Family Business: Definition and Concept of entrepreneurship**,** Entrepreneur Characteristics**,** Classification of Entrepreneurs**,** Role of Entrepreneurship in Economic Development –Start-ups**,** Knowing the characteristics of Family business with discussion on few Indian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.

Unit- II

Evaluating Business opportunity: Sources of business ideas and opportunity recognition, Guesstimating the market potential of a business idea**,** Feasibility analysis of the idea**,** Industry, competition and environment analysis.

Unit- III

Building Blocks of starting ventures: Low cost Marketing using digital technologies, Team building from scratch**,** Venture Funding**,** Establishing the value-chain and managing operations**,** Legal aspects like IPR and Compliances 81.

Unit- IV

Start-up Ecosystem: Know the components of the start-up ecosystem including Incubators,Accelerators, Venture Capital Funds, Angel Investors etc.Know various govt. schemes like Start-up India, Digital India, MSME etc.Sources of Venture Funding available in IndiaSource of Technology, Intellectual Property management.

Suggested Readings:

- Startup India Learning Program by Start Up India available
- www.startupindia.gov.in
- Entrepreneurship, Rajeev Roy, Oxford University Press
- Entrepreneurship: Successfully Launching New Ventures by R. Duane Ireland Bruce R.
- Barringer, Pearson Publishing
- Family Business Management by Rajiv Agarwal, Sage Publishing
- Anish Tiwari (2003), “Mapping the Startup Ecosystem in India”, Economic & Political
- Ramachandran, K, Indian Family Businesses: Their survival beyond three generations,
- ISB Working Paper Series

Useful Video links:

Unit No.	Topics	Links
1	**Entrepreneurship**	https://nptel.ac.in/courses/107101092
2	**Feasibility analysis**	https://nptel.ac.in/courses/110105067
3	**Cost Marketing**	https://nptel.ac.in/courses/110105067
4	**Ecosystem**	https://nptel.ac.in/courses/105105826

Course Code	**CC-BCA-204B**				
Category	**Core Courses**				
Course Title	**Computer Networks**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to ● To understand the fundamental concepts of computer networks, network models, topologies, transmission modes, and networking devices. ● To understand data link layer functions, Ethernet operations, IP addressing, subnetting, ARP, VLANs, and network protocols. ● To understand routing techniques, transport and application layer protocols, network security, and emerging networking technologies.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** fundamentals of computer networks including models, topologies, transmission modes, and networking devices.	Level-1 Remember
CO2	**Explain** data link layer functions, Ethernet, IP addressing, subnetting, ARP, and VLAN concepts.	Level-2 Understand
CO3	**Apply** routing techniques, transport layer mechanisms, congestion control methods, and network security principles in networking scenarios.	Level-3 Apply
CO4	**Analyze** application layer protocols, emerging networking technologies, and network management and performance techniques.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Introduction to Computer Networks

Overview of Computer Networks: Definition and Objectives, Applications and Examples Network Components and Architecture

Network Models: OSI Model: Layers and Functions, TCP/IP Model: Layers and Functions

Comparison between OSI and TCP/IP Models
Network Topologies: Physical vs. Logical Topologies, Common Topologies: Star, Ring, Bus, Mesh, Hybrid, Advantages and Disadvantages of Each Topology

Data Transmission: Analog vs. Digital Signals, Transmission Modes: Simplex, Half-Duplex, Full-Duplex, Bandwidth and Latency
Networking Devices: Routers, Switches, Hubs, Bridges, Gateways, Functions and Configurations of Each Device.

Unit -II

Data Link Layer and Networking Protocols
Data Link Layer Fundamentals: Functions of the Data Link Layer, Framing, Error Detection, and Error Correction, Flow Control Mechanisms.
Ethernet: Ethernet Standards and Frame Structure, MAC Addressing and ARP, Ethernet Switching: Basic Concepts and Methods
Network Protocols: Introduction to TCP/IP Protocol Suite, IP Addressing: IPv4 and IPv6 Subnetting and CIDR Notation
Address Resolution Protocol (ARP): ARP Operation and Table, ARP Spoofing and Security Considerations
Virtual LANs (VLANs): Concept of VLANs, VLAN Tagging and Configuration, Benefits and Use Cases

Unit- III

Network Layer and Transport Layer
Network Layer: IP Routing: Static vs. Dynamic Routing,Routing Protocols: RIP, OSPF, BGP, Network Address Translation (NAT)
Transport Layer: TCP vs. UDP: Characteristics and Use Cases, TCP Handshake and Connection Management, Flow Control and Congestion Control in TCP
Congestion Control Algorithms: Techniques: Slow Start, Congestion Avoidance, Fast Retransmit, Fast Recovery, TCP Variants: TCP Reno, TCP Vegas.
Quality of Service (QoS): QoS Principles and Mechanisms, Differentiated Services (DiffServ) and Integrated Services (IntServ)
Network Security Fundamentals: Threats and Vulnerabilities, Basic Security Mechanisms: Firewalls, VPNs, Encryption

Unit -IV

Application Layer and Emerging Technologies
Application Layer Protocols: HTTP/HTTPS: Structure and Operation, FTP, SMTP, POP3, IMAP: Protocols and Uses, DNS: Domain Name System and Resolution
Network Applications: Web Browsing, Email Communication, File Transfer, Voice over IP (VoIP) and Streaming.
Emerging Technologies: Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT) and Its Impact on Networking

Network Management: SNMP: Simple Network Management Protocol, Network Monitoring Tools and Techniques.
Future Trends in Networking: 5G and Beyond, Network Automation and Artificial Intelligence in Networking.

Suggested Readings:

- Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2011.
- James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021.
- Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill Education, 2012.
- Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann, 2019.
- Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2023.
- Mastering PC Hardware & Networking, Khanna Publishing House, 2024.

Useful Video links:

Unit No.	Topics	Links
1	**Introduction to Computer Networks**	https://nptel.ac.in/courses/106105183
2	**Data Link Layer**	https://nptel.ac.in/courses/106105081
3	**Congestion Control Algorithms**	https://nptel.ac.in/courses/106105081
4	**Emerging Technologies**	https://nptel.ac.in/courses/106106243

Course Code	**LC-BCA-206B**				
Category	**Core Courses**				
Course Title	**Computer Networks Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to ● To understand the basic concepts of computer networks, including network models, topologies, transmission modes, and networking devices. ● To understand data link layer functions, Ethernet, IP addressing, subnetting, ARP, VLANs, and network protocols. ● To understand network configuration, performance measurement, simulation tools, security mechanisms, and troubleshooting techniques.				
Assessment	15 Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply basic network configurations, protocols, and services including IP settings, DNS resolution, and HTTP client-server applications.	Level-3 Apply
CO2	Analyze network performance, traffic behavior, and connectivity issues using tools such as ping, trace route, iperf, and Wireshark.	Level-4 Analyze
CO3	Evaluate network designs, VLAN configurations, routing setups, and security mechanisms in simulated environments.	Level-5 Evaluate
CO4	Create functional network solutions by designing topologies, configuring devices, deploying web servers, and implementing security features.	Level-6 Create

List of Experiments:

Experiment no.	Contents
1.	**Configure Basic Network Settings:** a) IP Address Configuration b) Subnet Mask and Gateway Settings
2.	**Implement Network Protocols:** a) Write a simple Python script to perform DNS resolution. b) Implement a basic HTTP client-server application.

3.	**Network Simulation:** a) Use network simulation tools (e.g., Cisco Packet Tracer) to design and simulate network topologies. b) Configure routers and switches in a simulated environment.
4.	**Performance Measurement:** a) Measure network performance using tools like `ping`, `trace route`, and `iperf`. b) Analyze network traffic using Wireshark.
5.	**Implement VLANs:** a) Configure VLANs on a switch and verify using simulation tools.
6.	**Set Up a Simple Web Server:** a) Deploy a basic web server and configure HTTP/HTTPS access.
7.	**Network Security Lab:** a) Implement basic firewall rules and VPN configurations. b) Perform vulnerability scanning and analyze results.
8.	**Network Troubleshooting:** a) Diagnose and resolve common network issues. b) Use troubleshooting commands and techniques to fix connectivity problems.

Useful Video links:

Experiment Name	Links
Configure Basic Network Settings: a) IP Address Configuration b) Subnet Mask and Gateway Settings	https://nptel.ac.in/courses/106105183
Network Simulation: a) Use network simulation tools (e.g., Cisco Packet Tracer) to design and simulate network topologies. b) Configure routers and switches in a simulated environment.	https://nptel.ac.in/courses/106105081
Network Security Lab: a) Implement basic firewall rules and VPN configurations. b) Perform vulnerability scanning and analyze results.	https://nptel.ac.in/courses/106105183
Set Up a Simple Web Server: a) Deploy a basic web server and configure HTTP/HTTPS access.	https://nptel.ac.in/courses/106105081

Course code	**CC-BCA-208B**				
Category	**Core Courses**				
Course title	**Probability and Statistics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	3	
Course Objectives:	The objectives of this course are • To acquired knowledge about Probability, Random Variables, various Discrete, Continuous Probability distributions and their properties. • To learn various Statistical methods and techniques to study data samples.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

CO	Skill Demonstrated	Level
CO1	**Recall** fundamental concepts, definitions, and theorems related to probability, random variables, distributions, and statistical measures.	Level 1:Remember
CO2	**Explain** the core concepts such as probability theorems, properties of distributions, and statistical methods for data analysis.	Level 2:Understand
CO3	**Apply** probability theory and statistical techniques to solve problems in real-world scenarios.	Level 3:Apply
CO4	**Analyze** statistical data and probability distributions to identify relationships between variables, evaluate assumptions, and interpret the implications of test results.	Level 4:Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit- I

Basic concepts of Statistics, qualitative and quantitative data, classification of data, construction of frequency distribution, diagrammatic representation of data.

Measures of Central Tendency: Arithmetic mean, median and mode—their properties

Measures of Dispersion: Range, mean deviation, quartile deviation, variance and standard deviation.

Unit- II

Correlation: Definition, scatter diagram, types of correlation, measures—Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient.

Regression: Linear regression-fitting by least square method and interpretation.

Unit-III

Concepts of probability: Experiment and sample space, events and operations with events, Probability of an event, basic probability rules, applications of probability rules, conditional probability.
Random Variables: Discrete and continuous random variable**,** probability distribution of a random variable**,** probability mass function, probability density function, expectation and variance of a random variable.
Standard Probability Distributions: Binomial probability distribution, Poisson probability distribution, Normal probability distribution.

Unit-IV

Sampling Distribution: Concept of Population and Sample, parameter and statistic, sampling distribution of sample mean and sample proportion.
Statistical Inference: Estimation and Hypothesis Testing (only concept).
Hypothesis Testing for a Single Population: Concept of a hypothesis testing, tests involving a population mean and population proportion (z test and t test).
Chi square test for independence of attributes and goodness of fit.

Suggested Readings:

- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers .
- E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
- N. P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications.
- P. Mukhopadhyay, Mathematical Statistics, Books and Allied Private Limited, Kolkata.
- S.C. Gupta, and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
- S. Ross, A First Course in Probability, Pearson Education .
- R. Jain and S.C. Aggarwal, Business Statistics, VK Global Publications Pvt. Ltd.

Video URL links

Unit No.	Topics	Links
UNIT-I	Introduction to Probability and Statistics	https://onlinecourses.nptel.ac.in/noc22_ma81/preview) https://archive.nptel.ac.in/courses/109/104/109104182/
UNIT-II	Correlation	https://nptel.ac.in/courses/111106112
	Regression	https://nptel.ac.in/courses/111105041
UNIT-III	Concepts of probability	https://onlinecourses.nptel.ac.in/noc22_ma81/preview
	Random Variables	https://youtu.be/2CP3m3EgL1Q
	Standard Probability Distributions	https://youtu.be/60vHy2lA4o4
UNIT-IV	Sampling Distribution	https://onlinecourses.nptel.ac.in/noc22_ma81/preview
	Hypothesis Testing for a Single Population.	https://youtu.be/14PQawp_rjk

Course Code	**CC-BCA-210B**				
Category	**Core Courses**				
Course Title	**Artificial Intelligence**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are to • To understand the concepts of data types, feature engineering, preprocessing, transformation, feature selection, and feature reduction. • To understand feature engineering techniques including preprocessing methods, numerical and categorical data handling, and dimensionality reduction. • To understand the application of feature engineering techniques for data preprocessing, feature transformation, encoding, selection, and reduction on datasets.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** the concepts of data types, feature engineering, preprocessing, transformation, feature selection, and feature reduction.	Level-1 Remember
CO2	**Explain** feature engineering concepts including data types, preprocessing methods, numerical and categorical techniques, and feature selection and dimensionality reduction.	Level-2 Understand
CO3	**Apply** feature engineering techniques for preprocessing, transformation, encoding, selection, and dimensionality reduction on datasets.	Level-3 Apply
CO4	**Analyze** feature engineering methods including preprocessing, transformations, feature selection, and dimensionality reduction techniques.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 5 parts of 2 marks each from all units and remaining 8 questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit- I

Introduction to Feature Engineering

Introduction to Data and Features: Importance of Features in Machine Learning. Data types and features: Numerical, Categorical, Ordinal, Discrete, Continuous, Interval and Ratio

Unit –II

Basic Feature Engineering

Basic Feature Preprocessing: Handling Missing Data, Data Cleaning, Feature Scaling, Normalization, and Transformation.

Unit- III

Feature Engineering Techniques I

Techniques for Numerical Data: Binning and Discretization, Polynomial and Interaction Features. Categorical Data Techniques: One Hot Encoding, Label Encoding.

Unit -IV

Feature Engineering Techniques II

Feature extraction vs. feature selection, Steps in feature selection. Feature Selection Methods: Filter, Wrapper, and Hybrid. Feature Reduction: Introduction and application of Principal Components Analysis.

Suggested Readings:

- M.C. Trivedi, Data Science and Data Analytics Using Python Programming, Khanna Publishing House, 2024.
- Zheng, Alice, & Casari, Amanda. (2018). Feature engineering for machine learning:
- Principles and techniques for data scientists. O'Reilly Media, Inc.
- Kalita, J. K., Bhattacharyya, D. K., & Roy, S. (2023). Fundamentals of Data Science:
- Theory and Practice. Elsevier. ISBN-13: 9780323917780.
- Duda, R. O., Hart, P. E., Stork, D (2007). Pattern classification (2Ed), John Wiley & Sons, ISBN-13: 978-8126511167.
- N. Bhaskar, Vasundhara, Machine Learning, Khanna Publishing House, 2024.
- M.C. Trivedi, Deep Learning and Neural Network_MC Trivedi, Khanna Publishing House, 2024.
- Ng, Andrew. (2018). Machine learning yearning (Draft, MIT Licensed). GitHub. ISBN- 10: 199957950X, ISBN-13: 978-1999579500.
- Han, Jiawei, Kamber, Micheline, & Pei, Jian. (2011). Data mining: Concepts and techniques (3rd ed.). Morgan Kaufmann Publishers. ISBN 978-0123814791.
- Tan, Pang-Ning, Steinbach, Michael, Karpatne, Anuj, & Kumar, Vipin. (2021). Introduction to data mining (2nd ed.). Pearson. ISBN 978-9354491047.
- Provost, Foster, & Fawcett, Tom. (2013). Data science for business: What you need to know about data mining and data-analytic thinking. O'Reilly Media, Inc.
- Galli, Soledad. (2020). Python feature engineering cookbook: Over 70 recipes for creating, engineering, and transforming features to build machine learning models. Packt Publishing, Limited.
- Nielsen, Aileen. (2019). Practical time series analysis: Prediction with statistics and machine learning. O'Reilly Media.
- Rajiv Chopra, Deep Learning, Khanna Publishing House, 2024.
- Jeeva Jose, Machine Learning, Khanna Publishing House, 2024.
- Chollet, François. (2017). Deep learning with Python. Manning Publications. ISBN 9781617294433.

Course Code	**LC-BCA-212B**				
Category	**Core Courses**				
Course Title	**Artificial Intelligence Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts of artificial intelligence, search algorithms, and problem-solving techniques. • To understand constraint satisfaction, logical reasoning, and optimization methods used in AI systems. • To understand natural language processing techniques, rule-based systems, and machine learning applications in AI.				
Assessment	15Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply search algorithms, constraint satisfaction techniques, and optimization methods to solve basic AI problems.	Level-3 Apply
CO2	Analyze problem spaces using graph search, adversarial search, and logical reasoning techniques in artificial intelligence.	Level-4 Analyze
CO3	Evaluate AI models and approaches including rule-based systems, NLP techniques, and expert systems for decision-making tasks.	Level-5 Evaluate
CO4	Create AI applications such as chatbots, NLP pipelines, and CNN-based image classification systems using Python frameworks.	Level-6 Create

List of Experiment:-

Experiment no.	Contents
1.	Demonstrate basic problem-solving using Breadth-First Search on a simple grid.
2.	Implement Depth-First Search (DFS) on a small graph.
3.	Solve the Water Jug Problem using Breadth First Search (BFS).
4.	Implement a Hill Climbing search to find the peak in a numeric dataset.
5.	Apply the A* Search algorithm to find the shortest path in a 4x4 grid.
6.	Implement the Minimax search algorithm for 2-player games. You may use a game tree with 3 plies.
7.	Solve the 4 – Queens Problem as a CSP backtracking problem.

8.	Use constraint propagation to solve a Magic Square puzzle.
9.	Apply optimization techniques to find the maximum value in a list.
10.	Represent and evaluate propositional logic expressions.
11.	Implement a basic rule-based expert system for weather classification.
12.	Implement a basic AI agent with simple decision-making rules.
13.	Implement a basic Rule-Based Chatbot.
14.	Using Python NLTK, perform the following Natural Language Processing (NLP) tasks for text content. a) Tokenizing b) Filtering Stop Words c) Stemming d) Part of Speech tagging e) Chunking f) Named Entity Recognition (NER)
15.	Perform Image classification for a given dataset using CNN. You may use Tensor flow /Keras.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Course Code	**SEC-BCA-202B**				
Category	**Skill Enhancement Courses**				
Course Title	**Design Thinking and Innovation**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	1	1	0	**2**	
Course Objectives	The objectives of this course are • To understand the concepts and process of design thinking and innovation. • To develop creative problem-solving and customer-centric thinking skills. • To familiarize students with ideation, prototyping, and implementation techniques. • To develop skills in feedback analysis and innovative solution design.				
Assessment	15Marks				
End Semester Examination	35 Marks				
Total	50Marks				
Duration of Exam	03Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, principles, stages, and significance of design thinking, innovation, and customer-centric problem-solving.	Level-1Remember
CO2	**Describe** empathy, ideation, prototyping, implementation, feedback mechanisms, and user-focused design approaches in the innovation process.	Level-2Understand
CO3	**Apply** design thinking tools and techniques to identify problems, generate ideas, develop prototypes, and enhance customer experience in business situations.	Level-3Apply
CO4	**Analyze** customer needs, design challenges, feedback systems, and innovative solutions to improve product and service experiences.	Level-4Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have7 parts of 1 mark each from all units and remaining 8 questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

Basics of Design Thinking: Concept of Innovation, Significance of Innovation in Business, Creative Thinking Process, Problem Solving Approaches, Design Thinking Approach, Objectives of Design Thinking, Design Thinking and Customer Centricity, Customer Challenges, Enhancing Customer Experience through Design Thinking, Parameters of Product Experience, Alignment of Customer

Expectations with Product, Global Success Stories of AirBnB, Apple, IDEO, Netflix, Stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement.

UNIT – II

Learning to Empathize and Define the Problem: Importance of Empathy in Innovation Process, Development of Empathy using Design Tools, Observation and Assimilation of Information, Individual Differences and Uniqueness, Group Discussions and Activities for Understanding Individual Differences, Wicked Problems, Identification of Wicked Problems, Impact of Solutions to Wicked Problems.

UNIT – III

Ideate, Prototype and Implement: Ideation Templates, Brainstorming, Systems Thinking, Concept of Brainstorming, Consensus Building on Wicked Problems, Mapping Customer Experience for Ideation, Methods of Prototyping, Rapid Prototyping, Implementation Process.

UNIT – IV

Feedback, Re-Design & Re-Create: Feedback Loop, User Experience, Ergonomic Challenges, User-Focused Design, Final Concept Testing, Final Presentation, Innovative Design Concepts, Creative Problem-Solving Solutions.

Suggested Readings:

- Developing Thinking Skills (The way to Success) by E Balaguruswamy , Khanna Book Publishing Company.
- Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown, Harvard Business Review.
- 8 steps to Innovation by R T Krishnan & V Dabholkar, Collins Publishing.
- Design Thinking by Nigel Cross, Bloomsbury.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Design Thinking	https://viit.digimat.in/nptel/courses/video/109104109/L01.html
Unit-II	Design Thinking Phases – Empathy	http://www.digimat.in/nptel/courses/video/107107580/L02.html
Unit-III	Brain Storming	https://tkiet.digimat.in/nptel/courses/video/109107155/L33.html
Unit-IV	Creative Problem Solving	https://tkiet.digimat.in/nptel/courses/video/109107155/L15.html

Discipline Specific Elective Course (BCA Only)

Course Code	DSE-BCA-202B				
Category	Discipline Specific Elective				
Course Title	**Advance Database Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	1	0	0	**1**	
Course Objectives	The objectives of this course are • To understand the fundamentals of advanced database systems and EER modeling. • To explore object-oriented and object-relational database concepts. • To learn parallel and distributed database techniques. • To study advanced database models and emerging database technologies.				
Assessment	05 Marks				
End Semester Examination	20 Marks				
Total	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamentals of advanced database systems, EER model, and database architecture.	Level-1 Remember
CO2	Explain object-oriented databases, object-relational databases, and information retrieval concepts.	Level-2 Understand
CO3	Apply the concepts of parallel and distributed databases for data management and query processing.	Level-3 Apply
CO4	Analyze client–server architecture, advanced database models, and emerging database technologies.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts of 1 mark each from all units and remaining 8 questions of 4 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Advanced Database Systems, applications, Enhanced Entity-Relationship (EER) Model, specialization, generalization, inheritance, and three-schema architecture with data independence.

UNIT-II

Introduction to Object-Oriented Databases, object-oriented concepts, object identity, inheritance, object-relational databases, user-defined data types, and basics of information retrieval.

UNIT-III

Fundamentals of Parallel and Distributed Databases, parallel database architectures, distributed database architecture, data fragmentation, replication, and basic query processing.

UNIT-IV

Overview of Client–Server Architecture, active and temporal databases, spatial databases, multimedia databases, mobile databases, Geographic Information Systems (GIS), and introduction to XML and web databases.

Reference Books

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education.
2. Korth, Silberchatz, and Sudarshan: Database System Concepts, McGraw-Hill.
3. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, McGraw-Hill.
4. Peter Rob and Coronel: Database Systems – Design, Implementation, and Management, Thomson Learning.
5. C. J. Date: Introduction to Database Systems, Pearson Education.
6. Thomas Connolly and Carolyn Begg: Database Systems, Pearson Education.
7. W. H. Inmon: Building Data Warehouse, John Wiley & Sons.
8. S. Anahory and D. Murray: Data Warehousing, Pearson Education Asia.
9. Jiawei Han and Micheline Kamber: Data Mining – Concepts and Techniques, Harcourt India Pvt. Ltd. (Morgan Kaufmann Publishers).
10. Michall Corey, M. Abbey, I. Abramson, and Ben Taub: Oracle 8i Building Data Warehousing, Tata McGraw-Hill (TMH).
11. A. K. Pujari: Data Mining Techniques, University Press.

Video Links

Topics	Links
Advanced Database Models	https://youtu.be/9MEVHebExhw?si=zDyMGsNQSVHfHSea
Parallel and Distributed Databases	https://youtu.be/QbyyBcVCfQc?si=_B0lBi6OTLXhj8Ug
Client-Server Architectures	https://youtu.be/q0JBXtZ3ixY?si=bRlwgzKuGTJEvVp3
Enhanced Database Models	https://youtu.be/PqPkYmRSQ_w?si=Rft7303Ntq83Ds25
Emerging Database Technologies and XML	https://youtu.be/RcSa_Audhm0?si=CJm-FUOcGQyvjcB6

Course Code	**LC-BCA-214B**				
Category	Discipline Specific Elective				
Course Title	**Advance Database Systems Lab**				
Scheme and Credits	L	T	P	**Credit**	**Semester-IV**
	0	0	4	**2**	
Course Objectives	• To study the evolution of database systems and their role in handling complex and large-scale data applications. • To understand the design principles and implementation issues of object-oriented, object-relational, parallel, and distributed databases. • To examine advanced database mechanisms for data storage, retrieval, concurrency control, and recovery. • To explore modern trends in database technology, including XML, GIS, mobile databases, multimedia databases.				
Assessment	15 Marks				
End Semester Examination	35Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply advanced database models, EER concepts, object-oriented and object-relational database techniques to design database solutions.	Level-3 Apply
CO2	Analyze the architectures and operations of parallel, distributed, and client-server database systems.	Level-4 Analyze
CO3	Evaluate advanced database technologies, including active, temporal, spatial, deductive, and distributed database systems.	Level-5 Evaluate
CO4	Create database solutions using emerging technologies such as XML, web databases, mobile databases, and GIS.	Level-6 Create

List of Experiment:-

EXP No.	EXPERIMENTS
1	Create tables for Student, Course, and Enrollment and define primary and foreign keys.
2	Demonstrate Generalization and Specialization using Employee and Manager tables.
3	Create SQL queries to illustrate Superclass and Subclass relationships.
4	Create a simple object type (Student_Type) and insert records.
5	Create and manipulate nested tables and collections.
6	Implement vertical fragmentation in a distributed database.
7	Implement horizontal fragmentation in a distributed database.
8	Write basic queries on object tables using OQL/SQL.
9	Create indexes and compare query execution time.
10	Demonstrate object views in an ORDBMS.
11	Create a database trigger for automatic record updates.
12	Create and query a simple XML document using XPath.

13	Design a basic multimedia database table for storing image information.
14	Develop a simple client-server database application for student records.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Discipline Specific Elective Course (BCA- Data Science)

Course Code	**DSE-BCA-DS-202B**				
Category	**Discipline Specific Elective**				
Course Title	**Data Visualization**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	1	0	0	**1**	
Course Objectives	The objectives of this course are • To understand the fundamental concepts of data visualization, including types of data, processes, and challenges. • To understand various visualization tools, storytelling techniques, and their role in effective communication. • To understand principles of designing effective visualizations, including color usage, dashboard design, and data modeling.				
Assessment	05Marks				
End Semester Examination	20 Marks				
Total	25 marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define concepts of data visualization, types of data, visualization tools, storytelling principles, and design elements.	Level-1 Remember
CO2	Explain the data visualization process, tool functionalities, storytelling techniques, and design principles for effective communication.	Level-2 Understand
CO3	Apply visualization tools, data storytelling methods, and design principles to create meaningful visual representations.	Level-3 Apply
CO4	Analyze visualizations, dashboards, and data models to assess effectiveness, limitations, and decision-making impact.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts of 1 mark each from all units and remaining 8 questions of 4 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Introduction to Data Visualization

Definition and importance of data visualization, Role of data visualization in decision making, Types of data (numerical, categorical, temporal, geographical)-Data visualization process (data collection, exploration, analysis, visualization, interpretation)-Challenges and limitations of data visualization.

UNIT – II

Visualization tools

Overview of Visualization Tools (e.g., Excel, Tableau, Power BI, Python)- Comparing and contrasting features and Use Cases among these tools.

UNIT – III

Data Storytelling

Principles of Data Storytelling: Narrative and Context-Best Practices for Dashboard Layout and Interactivity.

UNIT – IV

Designing Effective Visualizations

Principles of Good Visualization Design - Understanding and Using Color in Visualizations – Importance of Data Modelling in Visualization.

Reference Books :

- "Storytelling with Data: A Data Visualization Guide for Business Professionals" Cole Nussbaumer Knaflic, Wiley; 1st edition, 2015.
- “The Visual Display of Quantitative Information” by Edward Tufte, Graphics Press USA; 2nd edition, 2001.
- "Data Visualization: A Practical Introduction" Kieran Healy, Princeton University Press, 2018.
- "Analyzing Data with Power BI and Power Pivot for Excel", Alberto Ferrari and Marco Russo, Microsoft Press; 1st edition, 2017.
- "Microsoft Power BI Complete Reference", Devin Knight, Brian Knight, Mitchell Pearson, and Manuel Quintana, Packt Publishing; 1st edition, 2018.

Course Code	**LC-BCA-DS-204B**				
Category	**Discipline Specific Elective**				
Course Title	**Data Visualization Using Power BI LAB**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	4	**2**	
Course Objectives	The objectives of this course are • To understand the Power BI environment, including its interface, data sources, and report creation process. • To understand data preparation techniques such as importing, cleaning, transforming, and managing relationships using Power Query Editor. • To understand data visualization, report publishing, sharing, and dashboard management using Power BI Service.				
Assessment	15Marks				
End Semester Examination	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Apply Power BI tools and features to import data, perform transformations, and create basic reports.	Level-3 Apply
CO2	Analyze datasets by establishing relationships, resolving inconsistencies, and using calculated columns and measures.	Level-4 Analyze
CO3	Evaluate visualizations and reports for effectiveness, accuracy, and suitability for decision-making.	Level-5 Evaluate
CO4	Create interactive dashboards and reports using Power BI and deploy them through the Power BI Service	Level-6 Create

List of Experiments:

EXP. No.	Experiments
1	Installation and interface overview
2	Exploring the Power BI workspace: Ribbon, panes, and canvas.
3	Importing data from Excel and CSV files.
4	Introduction to multiple data sources
5	Basic report creation: Adding visuals and saving a report.
6	Using Power Query Editor
7	Cleaning data: Removing duplicates, handling missing values.
8	Transforming data: Splitting columns, changing data types, renaming columns.
9	Merging and appending queries.

10	Creating custom columns and calculated columns
11	Creating relationships between tables
12	Identifying and resolving data inconsistencies
13	Creating calculated columns and measures
14	Creating various chart types (bar, column, line, pie, area, etc.,)
15	Formatting and customizing visualizations
16	Publishing a report to Power BI Service.
17	Sharing reports and dashboards with team members.

At least 12 experiments to be studied/performed from the above list and other experiments can be studied/performed depending upon the scope of course as decided by the department.

Discipline Specific Elective Course (BCA- AIML)

Course Code	**DSE-BCA-AIML-202B**				
Category	**Discipline Specific Elective**				
Course Title	**Introduction to Machine Learning**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	1	0	0	**1**	
Course Objectives	The objectives of this course are to • To understand the fundamental concepts of machine learning, including types of learning, datasets, and basic problem formulations. • To understand machine learning processes such as model training, validation, testing, and performance evaluation metrics. • To understand machine learning techniques including regression, classification, clustering, neural networks, and real-world applications.				
Assessment	05Marks				
End Semester Examination	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** machine learning concepts including types, learning framework, evaluation metrics, algorithms, and applications.	Level-1 Remember
CO2	**Explain** supervised, unsupervised, and reinforcement learning, model training, evaluation, and key algorithms.	Level-2 Understand
CO3	**Apply** machine learning algorithms for regression, classification, clustering, neural networks, and evaluation.	Level-3 Apply
CO4	**Analyze** machine learning models using performance metrics, learning methods, clustering validation, and applications.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 4 parts of 1 mark each from all units and remaining 8 questions of 4 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit –I

Introduction to Machine Learning

Introduction: Definition, History and Application of Machine Learning, Types of Machine Learning: Supervised, Unsupervised, Semi-Supervised, and Reinforcement Learning. Labeled and Unlabelled Dataset. Supervised Learning Tasks: Regression vs. Classification.

Unit -II

Learning Framework and Evaluation Parameters
Learning Framework: Training, Validation and Testing of ML models. Performance Evaluation Parameters: Confusion matrix, Accuracy, Precision, Recall, F1 Score, and AUC.

Unit -III

Supervised Learning and Unsupervised Learning I
Regression: Linear and non-linear Regression, Logistic Regression. Classification: Naïve Bayes, K-Nearest Neighbors, Decision Trees. Linear model: Introduction to Artificial Neural Networks, Perceptron Learning Algorithm, Single Layer Perceptron.

Unit -IV

Supervised Learning and Unsupervised Learning II
Introduction to Support Vector Machine for linearly separable data. Clustering: K-Means, Hierarchical Clustering, DBSCAN, Clustering Validation Measures. ML Applications: Ethical Considerations in Machine Learning, Case study and Real-world Applications.

Suggested Readings:

- Rajiv Chopra (2024), Machine Learning and Machine Intelligence, Khanna Publishing House.
- Jeeva Jose (2023), Introduction to Machine Learning, Khanna Publishing House.
- Mitchell T. (1997). Machine Learning, First Edition, McGraw-Hill.
- Kalita, J. K., Bhattacharyya, D. K., & Roy, S. (2023). Fundamentals of Data Science: Theory and Practice. Elsevier. ISBN9780323917780
- Flach, P. A. (2012). Machine Learning: The Art and Science of Algorithms that Make Sense of Data. Cambridge University Press. ISBN: 9781107422223, 2012.
- Duda, R. O., Hart, P. E., Stork, D (2007). Pattern classification (2Ed), John Wiley & Sons, ISBN-13: 978-8126511167.
- Haykin S. (2009). Neural Networks and Learning Machines, Third Edition, PHI Learning.
- Chollet, F. (2018). Deep Learning with Python. Manning Publications.
- Bishop, C. M. (2006). Pattern Recognition and Machine Learning. Springer.
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
- Géron, A. (2017). Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems* (1st ed.). O'Reilly Media.

Useful Video links:

Unit No.	Topics	Links
1	Introduction to Machine Learning	https://nptel.ac.in/courses/106105152
2	Learning Framework	https://nptel.ac.in/courses/106106139
3	Supervised Learning	https://nptel.ac.in/courses/106106139
4	K-Means	https://nptel.ac.in/courses/106105152

Course Code	**LC-BCA-AIML-204B**				
Category	**Discipline Specific Elective**				
Course Title	**Introduction to Machine Learning Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	4	**2**	
Course Objectives	The objectives of this course are to • To understand machine learning concepts including types of learning, datasets, and basic problem formulation. • To understand model building processes such as training, testing, validation, and performance evaluation techniques. • To understand machine learning algorithms including regression, classification, clustering, neural networks, and ensemble methods.				
Assessment	15Marks				
End Semester Examination	35Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Apply** machine learning algorithms including regression, classification, clustering, PCA, neural networks, and boosting on datasets.	Level-3 Apply
CO2	**Analyze** performance of models such as regression, classification, SVM, clustering, PCA, and ensemble methods using evaluation metrics and visualizations.	Level-4 Analyze
CO3	**Evaluate** machine learning techniques including decision trees, Naive Bayes, random forest, clustering, PCA, and perceptron models.	Level-5 Evaluate
CO4	**Design** machine learning solutions using appropriate supervised, unsupervised, neural network, and ensemble methods for real-world problems.	Level-6 Create

List of Experiments:

Exp No.	Contents
1.	Implement linear regression on a dataset and visualize the regression line.
2.	Implement logistic regression on a binary classification dataset and plot the decision boundary.
3.	Implement and evaluate the performance of Decision tree ID3/Cart classifier for any given dataset.
4.	Implement and evaluate the performance of the Naive Bayes Classifier on a given dataset.
5.	Build and evaluate a random forest classifier using a numerical dataset.

6.	Implement a support vector machine for linearly separable classes and visualize the margins and decision boundary.
7.	Implement K-Means clustering on a point dataset and visualize and evaluate the clusters.
8.	Implement hierarchical clustering on a dataset and plot the dendrogram.
9.	Implement DBSCAN clustering on a dataset and visualize and evaluate the clusters.
10.	Perform Principal Components Analysis (PCA) and apply any one or more classifiers to show the performance variation with or without feature reduction.
11.	Build a single layer perceptron model to classify AND, OR, and XOR problems (may use Tensor Flow/Keras) and visualize their decision boundaries. Also evaluate its performance.
12.	Demonstrate the concept of boosting using the AdaBoost algorithm.

Useful Video links:

Experiment name	**Links**
Implement hierarchical clustering on a dataset and plot the dendrogram.	https://nptel.ac.in/courses/106105152
Implement and evaluate the performance of the Naive Bayes Classifier on a given dataset.	https://nptel.ac.in/courses/106106139
Implement K-Means clustering on a point dataset and visualize and evaluate the clusters.	https://nptel.ac.in/courses/106105152
Perform Principal Components Analysis (PCA) and apply any one or more classifiers to show the performance variation with or without feature reduction.	https://nptel.ac.in/courses/106105152

Annexure AC/5.42

DEPARTMENT OF MANAGEMENT

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

AN AUTONOMOUS INSTITUTE | NAAC'A'GRADE INSTITUTE | AFFILIATED TO MDU, ROHTAK

Minutes of 4th meeting of Board of Studies of Management Department

The 4th meeting of the Board of Studies of Management Department was held on 05.06.2026 at 10:30 A.M in the Conference Hall of the Institute.
The following members were present for the BOS meeting:

S.NO	Name of the Member	Affiliation/Organization	Designation within Academic Council
1	Dr. Punam Devi	HOD & Professor, MGMT, GITAM, Kablana	Chairman
2	Dr. Pardeep Ahlawat	Subject Expert (Professor, IMSAR, MDU, Rohtak), University Nominee	Member
3	Dr. Sanjay Bhayana	Subject Expert (Professor, NIFTEM, Sonipat), Outside Parent University	Member
4	Dr. Ashutosh Nigam	Subject Expert (Professor, J. C. Bose University of S&T, YMCA, Faridabad)Outside Parent University	Member
5	Dr. Ashok Sangwan	Industry/ Corporate Sector	Member
6	Dr. Dipika	Professor, MGMT, GITAM Kablana	Member
7	Dr. Payush	Professor, MGMT, GITAM Kablana	Member
8	Dr. Bhawana Yadav	Associate Professor, MGMT, GITAM Kablana	Member
9	Dr. Manisha	Associate Professor, MGMT, GITAM Kablana	Member
10	Dr. Deepti	Associate Professor, MGMT, GITAM Kablana	Member
11	Mr. Ajay Kumar	Assistant Professor, MGMT, GITAM Kablana	Member
12	Ms. Preeti Sharma	Assistant Professor, MGMT, GITAM Kablana	Member
13	Mr. Sachin Gupta	Assistant Professor, MGMT, GITAM Kablana	Member
14	Mr. Umesh Bhardwaj	Assistant Professor, MGMT, GITAM Kablana	Member
15	Ms. Shalu	Assistant Professor, MGMT, GITAM Kablana	Member
16	Ms. Manju	Assistant Professor, MGMT, GITAM Kablana	Member
17	Ms. Bhumika Samal	Assistant Professor, MGMT, GITAM Kablana	Member
18	Ms. Twinkle Sharma	Assistant Professor, MGMT, GITAM Kablana	Member
19	Ms. Divya	Assistant Professor, MGMT, GITAM Kablana	Member
20	Mr. Joginder Singh Grewal	Assistant Professor, MGMT, GITAM Kablana	Member

21	Mr. Gourav	Assistant Professor, MGMT, GITAM Kablana	Member
22	Ms. Seema	Assistant Professor, MGMT, GITAM Kablana	Member
23	Mr. Yogesh	Assistant Professor, MGMT, GITAM Kablana	Member
22	Ms. Priyanka	Assistant Professor, MGMT, GITAM Kablana	Member
23	Ms. Geeta	Assistant Professor, MGMT, GITAM Kablana	Member
24	Ms. Poonam Garg	Assistant Professor, MGMT, GITAM Kablana	Member
25	Ms. Annu	Assistant Professor, MGMT, GITAM Kablana	Member
26	Ms. Divya	Assistant Professor, MGMT, GITAM Kablana	Member
27	Ms. Navin Kumari	Assistan Professor, MGMT, GITAM Kablana	Member
28	Ms. Nisha	Assistant Professor, MGMT, GITAM Kablana	Member
29	Ms. Monika Kumari	Assistant Professor, MGMT, GITAM Kablana	Member
30	Ms. Sarika	Assistant Professor, MGMT, GITAM Kablana	Member
31	Mr. Manoj Rathi	Assistant Professor, MGMT, GITAM Kablana	Member
32	Ms. Suman	Assistant Professor, MGMT, GITAM Kablana	Member
33	Ms. Shikha Gupta	Assistant Professor, MGMT, GITAM Kablana	Member
34	Mr. Kirth Singh	Alumni	Member

At the outset the Chairperson welcomed all the members present in the meeting. The agenda items, as circulated prior to the meeting, were taken up for discussion.

Agenda wise Discussions and Resolution

Item No. 4.1

Confirmation of the minutes of the 3rd Meeting of the Board of Studies (BOS) of the Management Department held on **26.12.2025**.

Resolved that the minutes of the 3rd Meeting of the Board of Studies (BOS) of Management Department held on 26.12.2025 (Annexure 4.1 Pages 1-5 already circulated) be confirmed.

Item No. 4.2

Follow-up action report of the decisions taken in the 3rd Meeting of Board of Studies held on 26.12.2025.

Resolved that the Follow up action report of the decisions taken in the 3rd Meeting of Board of Studies held on 26.12.2025 be noted (Annexure 4.2 Page 6).

Item No. 4.3

Approval of Scheme of Examinations for the BBA, BBA (Honours), and BBA (Honours with Research) Programmes from the 5th Semester to 8th Semester, and Syllabus of the 3rd Year of the BBA (A-Scheme) Programme, Academic Session 2026–27 be approved.

Resolved that the Scheme of Examinations for the BBA, BBA (Honours), BBA (Honours with Research) Programmes from the 5th Semester to 8th Semester and Syllabus for the 3rd Year of the BBA (A-Scheme) Programme from Academic Session 2026–27 be approved and further resolved that the same be recommended to Academic Council for approval. (Annexure 4.3 Pages 7-39).

Item No. 4.4

Approval of Revised Scheme of Examinations for the BBA, BBA (Honours), and BBA (Honours with Research) Programmes from 1st to 8th Semester, and Syllabus for the 1st Year and 2nd Year of the BBA (B-Scheme) Programme from Academic Session 2026–27.

Resolved that the revised Scheme of Examinations for the BBA, BBA (Honours), and BBA (Honours with Research) Programmes from 1st to 8th Semester, and Syllabus for the 1st Year and 2nd Year of the BBA (B-Scheme) Programme from Academic Session 2026–27 be approved and further resolved that the same be recommended to the Academic Council for approval. (Annexure 4.4 Pages 40-127).

Item No. 4.5

Approval of the Panel of Examiners for Theory Papers and Practical/Project Examinations for the BBA and MBA Programme.

Resolved that the Panel of Examiners for Theory Papers and Practical/Project Examinations for the BBA and MBA Programme be approved and the same be forwarded to COE, GITAM (Annexure 4.5 Pages 128-146) further resolved that the Chairperson of BOS can include in the panel of examiner with the permission of Head of Institute.

Item No. 4.6

Proposal to Start the Certificate Course on "Data Analysis using Excel" from Academic Session 2026–27.

Resolved that the Scheme of Examinations and Syllabus of the Certificate Course on "Data Analysis using Excel" from Academic Session 2026–27 be recommended to the Academic Council for approval. (Annexure 4.6 Pages 147-149)

Item No. 4.7

Proposed minor change in note in syllabus of MBA.

Resolved that the note mentioned in the syllabus, "At least four cases will be discussed, one from each unit", be replaced with the following:

"At least four cases will be discussed in the classroom, with a minimum of one case from each unit. However, the examiner may ask not more than one case-based question in the examination."

The Meeting concluded with thanks to the Chair.



Dr. Punam Devi
Chairperson
Board of Studies
Deptt. of Management

Annexure AC / 5.43

~~Annexure 4.3~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute
Approved by AICTE, New Delhi and Affiliated to MDU, Rohtak
NAAC 'A' GRADE

SCHEME OF EXAMINATIONS AND SYLLABI

OF

3-4 YEAR

BACHELOR OF BUSINESS ADMINISTRATION PROGRAM

(BBA)

WITH EFFECT FROM THE

SESSION 2026-27

Scheme of Studies and Examination

BBA – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination	Practical / Viva-Voce	Total	
1	Discipline Specific Course-Major Course	DSC-BBA-301A	Entrepreneurship and MSME	3	1	0	4	4	30	70	-	100	3
2	Discipline Specific Course-Major Course	DSC-BBA-303A	Principles of Marketing	3	1	0	4	4	30	70	-	100	3
3	Discipline Specific Course-Major Course	DSC-BBA-305A	Introduction to Human Resource Management	3	1	0	4	4	30	70	-	100	3
4	Discipline Specific Course-Major Course	DSC-BBA-307A	Business Taxation	3	1	0	4	4	30	70	-	100	3
5	Major Discipline Relevant Course (Vocational)-Minor	Refer Table No.-XV	----------	3	0	0	3	3	25	50	-	75	3
		Refer Table No.-XV	----------	0	0	2	2	1	10	-	15	25	3
6	Internship	INT-BBA-301A	Summer Internship Report	-	-	-	-	4	-	-	100	100	3
Total Credits								**24**				**600**	

Note:

1. Four credits of internship earned by a student during summer internship after the 2nd semester or 4th semester will be counted in the 5th semester of a student who pursues a 3-year UG Program without taking exit option.
2. After completion of the internship, students need to prepare a comprehensive report highlighting their learning and takeaways during the internship period. The internship duration is 8 weeks (online/offline/hybrid) during the summer vacation. The Internship Report prepared after completion shall be assessed in the 5th Semester as a compulsory course. The candidates will submit the internship report in the prescribed format designed by the department. The report will be evaluated by an examiner appointed by the Controller of Examination (or a committee constituted by the Director of the Institute) from the approved panel of examiners.
3. Students may opt for one course **@ four credits** from the pool of Minor and Minor (Vocational) Courses designed at the central level by the Institute.

Table No. XV Major Discipline Relevant (Vocational) -Minor Courses

S. No.	Category	Course Code	Course Name
1	Major Discipline Relevant Course (Vocational) – Minor	MICV-307A	Business Policy and Strategy
2		MICV-309A	Computer Networks and Internet
3		LC-MICV-311A	Computer Networks and Internet Lab

Scheme of Studies and Examination
BBA – 6th Semester
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination	Practical / Viva-Voce	Total	
1	Discipline Specific Course-Major Course	DSC-BBA-302A	Research Methodology	3	1	0	4	4	30	70	-	100	3
2	Discipline Specific Course-Major Course	DSC-BBA-304A	Event Management	3	0	1	4	4	-	50	50	100	3
3	Discipline Specific Course-Major Course	DSC-BBA-306A	Financial Management	3	1	0	4	4	30	70	-	100	3
4	Discipline Specific Course-Major Course	DSC-BBA-308A	Operations and Supply Chain Management	3	1	0	4	4	30	70	-	100	3
5	Research Project	RP-BBA-306A	Research Report	-	-	-	4	4			100	100	3
6	Major Discipline Relevant Course (Vocational)-Minor	Refer Table No. XVI	…….	3	0	0	3	3	25	50	-	75	3
			…….	0	0	2	2	1	10	-	15	25	3
Total Credits								**24**				**600**	

Note:
1. Students exiting the programme shall be awarded a 3-year UG Degree in Business Administration upon securing 140 credits.
2. Each student in the course of Event Management will organize one event during the semester, and students need to prepare a report highlighting their learning and takeaways. The report will be evaluated by an examiner appointed by the Controller of Examination (or a committee constituted by the Director of the Institute) from the approved panel of examiners.
3. In case of the Project reports/ Dissertation/ Research Project, the assessment shall be carried out by the examiners appointed by the Controller of Examination from the approved panel of examiners. The examiners shall be invited from amongst the panel of examiners.
4. Students may opt for one course @ four credits from the pool of Minor and Minor (Vocational) Courses designed at the central level by the Institute.

Total Credits (22+22+24+24+24+24) for 3-Years UG Degree in Business Administration	**140**

Table No. XVI Major Discipline Relevant (Vocational) -Minor Courses

S. No.	Category	Course Code	Course Name
1	Major Discipline Relevant Course (Vocational) – Minor	MICV-308A	Entrepreneurship Development
2		MICV-310A	Web Development
3		LC-MICV-312A	Web Development Lab

Re-entry Criteria into Fourth Year (Seventh Semester)

- The student who takes an exit after third year with an award of BBA may be allowed to re-enter into the seventh semester for completion of the BBA (Honours) or BBA (Honours with Research) Program as per the Institute schedule after earning requisite credits in the Third year.
- Minimum eligibility criteria for opting the course in the fourth year will be as follows:
  - For BBA (Honours): Completion of 3-Year BBA Degree.
  - BBA (Honours with Research): Minimum 75% marks or equivalent CGPA in BBA Degree up to Sixth Semester.

Scheme of Studies and Examination

BBA – 7th Semester (Common for Honours and Honours with Research)

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination	Practical / Viva-Voce	Total	
1	Discipline Specific Course-Major Course	DSC-BBAH-401A	Management Process and Organizational Behaviour	3	1	0	4	4	30	70	-	100	3
2	Discipline Specific Course-Major Course	DSC-BBAH-403A	Finance for Managers	3	1	0	4	4	30	70	-	100	3
3	Discipline Specific Course-Major Course	DSC-BBAH-405A	Managerial Economics	3	1	0	4	4	30	70	-	100	3
4	Discipline Specific Course-Major Course	DSC-BBAH-407A	Business Environment	3	1	0	4	4	30	70	-	100	3
5	Discipline Specific Course-Major Course	DSC-BBAH-409A	Business Research Methods	3	1	0	4	4	30	70	-	100	3
6	Skill Enhancement Course	SEC-401A	Business Ethics and Communication Skills	2	0	0	2	2	15	35	-	50	3
		LC-SEC-403A	Business Ethics and Communication Skills Lab	0	0	4	4	2	15	-	35	50	3
7	Major Discipline Relevant Course (Vocational)-Minor	MICV-401A	IT for Managers-I	2	0	0	2	2	15	35	-	50	3
		LC-MICV-403A	IT for Managers-I Lab	0	0	4	4	2	15	-	35	50	3
8	Internship	INT-BBA-401A	Internship Report	-	-	-	-	4	-	-	100	100	3
Total Credits								**24**				**600**	

Note:

1. The students are required to choose either SEC or MICV or Internship**.** In the 7th and 8th Semester, students shall be offered three optional papers (Skill-Enhancement Course/ Vocational Course/ Internship) in each semester. Each student must choose one subject in each semester. The subject opted in the 8th semester shall be the continuation of the subject opted in the 7th semester.
2. Those students opting for an internship in the 7th semester follow the guidelines. After completion of the internship, students need to prepare a comprehensive report highlighting their learning and takeaways during the internship period. The internship duration is 8 weeks (online/offline/hybrid) during the summer vacation. The Internship Report prepared after completion shall be assessed as a compulsory course. The candidates will submit the internship report in the prescribed format designed by the department. The report will be evaluated by an examiner appointed by the Controller of Examination (or a committee constituted by the Director of the Institute) from the approved panel of examiners.

Scheme of Studies and Examination

BBA (Honours) – 8th Semester

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination	Practical / Viva-Voce	Total	
1	Discipline Specific Course-Major Course	DSC-BBAH-402A	Strategic Marketing	3	1	0	4	4	30	70	-	100	3
2	Discipline Specific Course-Major Course	DSC-BBAH-404A	Strategic Human Resource Management	3	1	0	4	4	30	70	-	100	3
3	Discipline Specific Course-Major Course	DSC-BBAH-406A	Management Information System	3	1	0	4	4	30	70	-	100	3
4	Discipline Specific Course-Major Course	DSC-BBAH-408A	Total Quality Management	3	1	0	4	4	30	70	-	100	3
5	Discipline Specific Course-Major Course	DSC-BBAH-410A	Emotional Intelligence	3	1	0	4	4	30	70	-	100	3
6	Skill Enhancement Course	SEC-402A	Personality and Soft Skills Development	2	0	0	2	2	15	35	-	50	3
		LC-SEC-404A	Personality and Soft Skills Development Lab	0	0	4	4	2	15	-	35	50	3
7	Major Discipline Relevant Course (Vocational)-Minor	MICV-402A	IT for Managers-2	2	0	0	2	2	15	35	-	50	3
		LC-MICV-404A	IT for Managers-2 Lab	0	0	4	4	2	15	-	35	50	3
8	Internship	INT-BBA-402A	Internship Report	-	-	-	-	4	50	-	50	100	3
Total Credits								**24**				**600**	

Note:

1. The students are required to choose either SEC or MICV or Internship**.** In the 7th and 8th Semester, students shall offered three optional papers (Skill-Enhancement Course/ Vocational Course/ Internship) in each semester. Each stud must choose one subject in each semester. The subject opted in the 8th semester shall be the continuation of the subj opted in the 7th semester.
2. Those students opting for an internship in the 7th semester follow the guidelines. After completion of the internsh students need to prepare a comprehensive report highlighting their learning and takeaways during the internship peri The internship duration is 8 weeks (online/offline/hybrid) during the summer vacation. The Internship report prepa after completion shall be assessed as a compulsory course. The candidates will submit the internship report in prescribed format designed by the department. The report will be evaluated by an examiner appointed by the Control of Examination (or a committee constituted by the Director of the Institute) from the approved panel of examiners.

Total Credits (22+22+24+24+24+24+24+24) for Four-Year BBA Honours	**188**

Scheme of Studies and Examination

BBA (Honours with Research) – 8th Semester

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination	Practical / Viva-Voce	Total	
1	Discipline Specific Course-Major Course	DSC-BBAHR-402A	Management Information System	3	1	0	4	4	30	70	-	100	3
2	Discipline Specific Course-Major Course	DSC-BBAHR-404A	Total Quality Management	3	1	0	4	4	30	70	-	100	3
3	Research Report/Dissertation	RP-BBAHR-406A	Research Report	-	-	-	12	12			300	300	3
4	Skill Enhancement Course	SEC-402A	Personality and Soft Skills Development	2	0	0	2	2	15	35	-	50	3
		LC-SEC-404A	Personality and Soft Skills Development Lab	0	0	4	4	2	15	-	35	50	3
5	Major Discipline Relevant Course (Vocational)-Minor	MICV-402A	IT for Managers-2	2	0	0	2	2	15	35	-	50	3
		LC-MICV-404A	IT for Managers-2 Lab	0	0	4	4	2	15	-	35	50	3
6	Internship	INT-BBA-402A	Internship Report	-	-	-	-	4	50	-	50	100	3
Total Credits								**24**				**600**	

Note:

1. The students are required to choose either SEC or MICV, or Internship. In the 7th and 8th semesters, students shall be offered three optional papers (Skill-Enhancement Course/Vocational Course/Internship) each semester. Each student must choose one subject in each semester. The subject opted in the 8th semester shall be the continuation of the subject opted in the 7th semester.

Those students opting for an internship in the 7th semester follow the guidelines. After completing the internship, students are required to prepare a comprehensive report highlighting their learning and key takeaways from the internship. The internship duration is 8 weeks (online/offline/hybrid) during the summer vacation. The Internship Report prepared after completion shall be assessed as a compulsory course. The candidates will submit the internship report in the prescribed format designed by the department. The report will be evaluated by an examiner appointed by the Controller of Examinations (or a committee constituted by the Director of the Institute) from the approved panel of examiners.

The topic of the Research Project to be submitted for evaluation in the eighth Semester shall be submitted by the student along with a brief synopsis after finalization in the 7th Semester, in consultation with the faculty member allotted as Research Supervisor by the HOD.

Any student opting for a dissertation has to submit a report to the department prepared in consultation with his/ her Research Supervisor and appear before a Department Research Committee (DRC) constituted by the HOD.

In case of the Project reports/ Dissertation/ Research Project, the assessment shall be jointly carried out by the internal and external examiners. In case of the Project reports/ Dissertation/ Research Project, the assessment shall be carried out by the examiners appointed by the Controller of Examination from the approved panel of examiners. The examiners shall be invited from amongst the panel of examiners.

6. Students undertaking the research project/dissertation may have their research findings patentable or presented at conferences or seminars, or published in peer-reviewed journals.

Total Credits (22+22+24+24+24+24+24+24) for Four-Year BBA Honours	**188**

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

Approved by AICTE, New Delhi and Affiliated to MDU, Rohtak

NAAC 'A' GRADE

SYLLABI

OF

5th & 6th SEMESTER

BACHELOR OF BUSINESS ADMINISTRATION PROGRAM

(BBA)

WITH EFFECT FROM THE

SESSION 2026-27

Course Code	**DSC-BBA-301A**				
Category	Discipline Specific Course - Major Course				
Course Title	**Entrepreneurship and MSME**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand the concept of entrepreneurship, its characteristics, process, and role in economic development, and the distinction between managerial and entrepreneurial approaches. 2. To develop the ability to analyze business opportunities through environmental scanning, feasibility studies, and preparation of business plans and project reports. 3. To gain knowledge about sources of finance and legal aspects, including funding options and intellectual property rights relevant to entrepreneurial ventures. 4. To understand the role and significance of MSMEs in India, including challenges, government initiatives, and the importance of innovation and entrepreneurship in their growth.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the fundamental concepts of entrepreneurship and MSME.	Level-1 Remember
CO2	**Explain** entrepreneurship concepts, entrepreneurial traits, venture creation, feasibility analysis, business planning, financing sources, legal aspects, and MSME support initiatives.	Level-2 Understand
CO3	**Apply** entrepreneurial concepts and analytical tools to prepare feasibility studies, business plans, project reports, and examine suitable financing and legal frameworks for entrepreneurial ventures and MSMEs.	Level-3 Apply
CO4	**Analyze** entrepreneurial opportunities, financing alternatives, legal challenges, MSME problems, and the role of innovation and government initiatives in promoting entrepreneurship and MSME growth.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.
2. At least four cases will be discussed, one from each unit.

Unit No.	Contents
Unit-I	**Entrepreneurship:–** Concept, knowledge and skills requirements, characteristics of successful entrepreneurs, the role of entrepreneurship in economic development, entrepreneurship process, factors impacting the emergence of entrepreneurship, managerial vs. entrepreneurial approach, and emergence of entrepreneurship. Digital and AI-Based Entrepreneurship, Green and Sustainable Entrepreneurship, Gig Economy and Startup Culture.
Unit-II	**Creating Entrepreneurial Venture:** – Environmental scanning, competitor and industry analysis; feasibility study – market feasibility, technical/operational feasibility, financial feasibility; drawing business plan; preparing project report; presenting business plan to investors, Agile and Lean Venture Creation, Digital Business Models and E-Commerce Ventures, Risk Analysis and Startup Failure Management, AI Tools for Business Planning.
Unit-III	**Sources of Finance:** – Debt or equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs, Crowdfunding and FinTech Financing, ESG and Sustainable Finance for Startups; legal issues – intellectual property rights patents, trademarks, copyrights, trade secrets, licensing, franchising.
Unit-IV	**Micro, Small and Medium-sized Enterprises (MSME) in India:** – Meaning and nature of MSME in India, Role of MSME in socio-economic development, problems faced by MSME, Role of innovation and entrepreneurship for MSME, Government initiatives for MSME sector, MSMEs and Industry 4.0, Women-Led MSMEs in India, Green MSMEs and Sustainable Practices,

Suggested Readings:

- Entrepreneurship by Hisrich, Robert D., Michael Peters and Dean Shephered, Tata McGraw Hill, New Delhi.
- Entrepreneurship by Barringer, Brace R., and R. Duane Ireland, Pearson Prentice Hall, New Jersy (USA).
- Entrepreneurship Development and Small Business Entreprises by Charantimath, Poornima, Pearson Education, New Delhi.
- Entrepreneurship by Kuratko, Donand and Richard Hodgetts, Cengage Learning India Pvt. Ltd., New Delhi.
- Essentials of entrepreneurship and small business management. Essex, Scarborough, N. M., & Cornwall, J.R. (2014). UK: Pearson.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Role of Entrepreneurship in Economic Development	https://nptel.ac.in/courses/127105007
Unit-II	Feasibility study	https://youtu.be/3ZTdXXI3Y00?si=2F23TV1KKAsuVnkm
Unit-III	Legal aspects like IPR and compliances	https://nptel.ac.in/courses/127105007
Unit-IV	Government initiatives for MSME sector	https://youtu.be/dwiy4J3jbi0?si=wK-etrE3RSgcxhVo

Course Code	**DSC-BBA-303A**				
Category	Discipline Specific Course - Major Course				
Course Title	**Principles of Marketing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are: 1. To understand strategic marketing concepts, the marketing mix (7P's) to align marketing and business strategies effectively. 2. To understand market segmentation, targeting, positioning strategies, and relationship marketing approaches. 3. To understand marketing strategies across product, branding, pricing, advertising and distribution. 4. To understand contemporary marketing issues and international marketing strategies.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, scope, functions, and contemporary trends of marketing and marketing management.	Level-1 Remember
CO2	**Explain** consumer and business buying behavior, market segmentation, product and pricing decisions, promotion strategies, and distribution systems.	Level-2 Understand
CO3	**Apply** marketing strategies and tools for customer relationship management, product development, branding, pricing, promotion, distribution and international marketing decisions.	Level-3 Apply
C O4	**Analyze** marketing environments, consumer behavior, competitive strategies and contemporary marketing issues for effective marketing decision-making.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.
2. At least four cases will be discussed, one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Marketing: -** Nature, Scope, Core Concepts, Tasks of Marketing Management, And Corporate Orientation Towards Marketplace; Marketing Environment; Marketing Research and Information System; Developing Marketing Strategy and Plan; Ethical Issues in Marketing, Sustainable and Green Marketing 2.0, Emerging Strategic Marketing Trends, AI and Technology-Based Marketing, Ethical AI and Privacy-Centric Marketing. Green Marketing, Digital and Social Media Marketing, Career Opportunities in Marketing and Skills Required for Success in Marketing career.
Unit-II	**Understanding Consumer and Business Markets:** - Consumer Buying Decision Process in Consumer and Business Markets; Building Customer Value, Satisfaction and Loyalty;

	Managing Customer Relations; Market Segmentation, Targeting and Positioning Approaches to Deal with Market Competition; Tools of Product Differentiation.
Unit-III	**Product and Pricing Decisions: -** Product Life Cycle, Product Mix and Product Line Decisions, New Product Development Process; Branding, Packaging and Labelling Decisions; Pricing Objectives, Determinants of Price, Pricing Methods and Strategies.
Unit-IV	**Promotion and Distribution Decisions:** - Promotion Mix - Advertising and Sales Promotion; Public Relations; Personal Selling; Channels of Distribution: Functions of Intermediaries, Channel Design Decisions, Selecting Channel Members, Channel Management; Wholesaling and Retailing. Retail and Commerce Innovations like Quick Commerce (Q-Commerce), etc., Contemporary Marketing Trends and Issues: Globalization, Consumerism, Evaluation and Control of Marketing Effort; Reasons for and Benefits of Going International; Entry Strategies in International Marketing.

Suggested Readings:

- Marketing Management by Kotler Philip and Keller, Pearson Education, New Delhi
- Marketing Management in South Asian Perspective by Kotler, Philip, Kevin Keller, A. Koshy and M. Jha, Pearson Education, New Delhi
- Marketing by Kerin, Hartley, Berkowtz and Rudelius, TMH, New Delhi
- Marketing: Concepts and Cases by Etzel, Michael J, TMH, New Delhi
- Marketing Management – Text and Cases by Dhunna, Mukesh, Wisdom Publications, New Delhi
- Managing Marketing-An Applied Approach by Capon, Noel and Singh Siddharth; Wiley Publications, New Delhi

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Marketing	https://onlinecourses.nptel.ac.in/noc22_mg57/preview
Unit-II	Market Segmentation, Targeting, and Positioning	https://digimat.in/nptel/courses/video/110107147/L23.html
Unit-III	Pricing Products and Service	https://digimat.in/nptel/courses/video/110107147/L39.html
Unit-IV	Promotion and Distribution Decisions	https://youtu.be/MPZgEJMS97o?si=XPB9zWjVyJnQhqGl

Course Code	**DSC-BBA-305A**				
Category	Discipline Specific Course - Major Course				
Course Title	Introduction to Human Resource Management				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are: 1. To understand the strategic importance, objectives, functions, and evolving role of Human Resource Management, including HR planning, HR information systems, and contemporary HR issues. 2. To develop knowledge of talent acquisition and development processes, including recruitment, selection, training, career planning, and succession planning. 3. To understand systems of performance appraisal and compensation management, including reward systems, incentive plans, and employee benefits. 4. To examine the role of HR in the knowledge era, including global HR practices, virtual organizations, outsourcing, HR audit, and international HRM.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Describe** the concepts, objectives, functions, and strategic importance of human resource management in organizations.	Level-1 Remember
CO2	**Explain** the human resource planning, talent acquisition, training and development, performance appraisal, compensation, and contemporary HR practices.	Level-2 Understand
CO3	**Apply** HRM techniques and practices for recruitment, training, performance management, compensation planning, and employee development in organizational settings.	Level-3 Apply
CO4	**Analyze** HR strategies, reward systems, HR technologies, and emerging HR practices in knowledge-based and global business environments.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.
2. At least four cases will be discussed, one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Human Resource Management: -** Strategic Importance of HRM; Objectives of HRM; Challenges to HR Professionals; Role, Responsibilities, and Competencies of HR Professionals; HR Department Operations; Human Resource Planning– Objectives and Process; Human Resource Information System, Contemporary Issues in Human Resource Management.

	Career Opportunities in Human Resource Management and Skills Required for Success in HR Careers.
Unit-II	**Talent Acquisition: -** Recruitment and Selection Strategies, Career Planning and Management, Succession Planning, Socialization and Induction of New Employees; Training and Development, Investment in Training, Training Need Assessment, Designing and Administering Training Programme; Executive Development Programme, Evaluation of T&D Programme.
Unit-III	**Appraising Performance: -** Developing and Instituting Performance Appraisal System, Assessment and Development Centres, Potential Appraisal; Rewarding Performance: Linking Rewards to Organizational Objectives, Determining Compensation Structure, Pay for Performance and Incentive Plans, ESOP, Executive Compensation, Designing and Administering Benefits and Services.
Unit-IV	**HR in Knowledge Era: -** HR in Knowledge Industry, HR in Virtual Organizations, HR In Mergers and Acquisitions, Outplacement, Outsourcing HR Functions, Employee Leasing, HR Audit, International HRM, Green HRM and Sustainable HR Practices, AI in Human Resource Management, People Analytics and HR Analytics.

Suggested Readings:

- Human Resource Management by Dessler, Gary, Pearson Education
- Human Resource Management by Ivanceivich, John M., Tata McGraw Hill, New Delhi
- Managing Human Resources by Gomez. Megia, Luis, David Balkin, and Roberty Cardy, Pearson Education
- Human Resource Management by Mathis, Robert, and John Jackson, Thomson Learning Inc.
- Human Resource Management by Shell, Scott and George Bohlander, Thomson Learning Inc.
- Human Resource Management by Pattanayak, Biswajert, PHI, New Delhi
- Human Resource Management by Jyothi P. and D.N.Venkatesh, Oxford University Press, New Delhi

Useful Video Links:

Unit No	Topics	Links
Unit-I	Human resource planning	https://youtu.be/FLRtMw8dD3E?si=Ka3hEWOdh94BLs92
Unit-II	Recruitment and Selection	http://www.digimat.in/nptel/courses/video/110107492/L20.html
Unit-III	Compensation Management	http://www.digimat.in/nptel/courses/video/110107492/L50.html
Unit-IV	International HRM	https://youtu.be/ndXWwf7VIig

Course Code	**DSC-BBA-307A**				
Category	Discipline Specific Course - Major Course				
Course Title	Business Taxation				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are: 1. To understand the basic concepts of income tax, including residential status, tax incidence, exempt incomes, and computation of income under salary and house property. 2. To develop knowledge of various heads of income, including business income, capital gains, and income from other sources, along with provisions of clubbing and set-off and carry forward of losses. 3. To examine deductions and tax procedures, including assessment of individuals and companies, TDS, advance tax, and concepts of tax planning, avoidance, and evasion. 4. To understand the structure and framework of GST in India, including its rationale, features, tax rates, and administrative mechanism.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the fundamental concepts of income tax and GST.	Level-1 Remember
CO2	**Explain** residential status, heads of income, deductions, tax procedures, GST framework, and tax planning concepts.	Level-2 Understand
CO3	**Apply** income tax provisions and GST rules for the computation of taxable income, assessment procedures, tax deductions, and compliance requirements.	Level-3 Apply
CO4	**Analyze** tax liabilities, loss adjustments, tax planning approaches, and GST structures for effective financial and tax decision-making.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.
2. At least four cases will be discussed, one from each unit.

Unit No.	Contents
Unit-I	**Fundamentals of Income Tax: Basic** Concepts of Income Tax, Residential status and tax incidence, Incomes exempt from tax, Computation of Income under the head Salary and House Property.

Unit-II	**Heads of Income & Loss Adjustments: -**Computation of Income under the head Business and Profession, Capital Gains, Income from Other Sources, Clubbing of income, Set off and Carry forward of Losses.
Unit-III	**Deductions and Tax Procedures:** General Deductions, Assessment of Individual and Company, Provision with regard to TDS and advance tax, Basic understanding of tax planning and its distinction from tax avoidance and tax evasion.
Unit-IV	**Goods and Services Tax (GST):-** Rationale for GST; features of GST law in India, structure of GST (SGST, CGST, UTGST and IGST); rates of GST, models of GST, GST Council, GST Automation using ERP Software.

Suggested Readings:

- Students Guide to Income Tax by Singhania, V., K. and Singhania, Monica, Taxmann
- Direct Taxes Law and practice by Singhania, V., K. and Singhania, Kapil, Taxmann
- Corporate Tax Planning & Business Tax Procedures by Singhania, V., K. and Singhania, Monica, Taxmann
- GST in India by Narwal, K.,P., and Anushuya, DBH Publishers and Distributers
- Simplified Approach to Corporate Tax Planning and Management by Ahuja, G. and Gupta, R., Bharat Law House Private Limited
- Handbook of Corporate Tax Planning by Srinivas, E. A., Tata McGraw Hill.
- Law of Income Tax by Iyengar, A. and C. Sampat, Bharat House.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Basic Concepts of Income Tax	https://nptel.ac.in/courses/110106512
Unit-II	Heads of Income & Loss Adjustments	https://youtu.be/9-XboEiyRvg?si=EOd2M6kRn8mgVyia
Unit-III	TDS and advance tax	https://youtu.be/j9Tf2RZo8e8?si=xGeT7ehImcRtKAHP
Unit-IV	Introduction to GST	https://nptel.ac.in/courses/110106512

Course Code	**MICV- 307A**				
Category	Major Discipline Relevant Course (Vocational) – Minor				
Course Title	**Business Policy and Strategy**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand the foundational concepts, processes, and significance of business policy and strategic management. 2. To understand various strategy types and their application at the corporate, business, and functional levels. 3. To understand the implementation aspects of strategy, including structural, behavioral, and functional dimensions. 4. To understand techniques for evaluating and controlling strategies, including McKinsey's 7S Framework.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the framework of business policy and strategic management, including strategic intent, environmental and organizational appraisal, types of strategies, implementation methods, evaluation and control techniques.	Level-1 Remember
CO2	**Explain** the framework of strategic management, including strategic intent, environmental and organizational appraisal, strategy types, implementation and control.	Level-2 Understand
CO3	**Apply** strategic tools and models such as SWOT, PEST, Porter's Five Forces, BCG Matrix, GE 9-cell Matrix, McKinsey's 7s Framework to formulate strategies, implement them through resource and structural planning and examine their effectiveness using control techniques.	Level-3 Apply
CO4	**Analyze** the internal and external environment, strategic alternatives at corporate, business, and functional levels, as well as implementation challenges related to structure, culture, leadership, ethics and strategic control systems.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to Business Policy and Strategic Management:-** Definition, Concept, Objective and Significance, the levels at which strategy operates, Strategic Management Process, strategic intent: Vision, Mission, Business definition, Goals, and Objectives. **Environment Appraisal:-** Concept and Environmental Sector; PEST Analysis, Organizational Appraisal: Concepts and Capability Factors; Porter's Value Chain Model, SWOT Analysis as a Tool for assessing Organizational Capabilities and Environmental Opportunities.

Unit-II	**Type of Strategies:** Corporate Level (Concept of Grand Strategies), Business Level, and Functional Level, Guidelines for Crafting Successful Business Strategies. Strategy Analysis and Choice: Corporate Level Strategy Analysis: BCG Matrix and GE 9 cell Matrix, Business Level Strategy Analysis: Life Cycle Analysis, Porter's Five Forces of Industry Analysis, Strategic Choice, and Process of Strategic Choice.
Unit-III	**Strategy Implementation:** Interrelation Between Strategy Formulation and Implementation, Aspects of Strategy Implementation, An overview of Project, Procedural Implementation, Resource Allocation, Structural Implementation. **Behavioural Implementation:** An overview of: Leadership, Corporate Culture, Corporate Politics and Use of Power, Personal Values and Business Ethics, Functional /Operational Implementation.
Unit-IV	**Strategy Evaluation and Control:** An Overview of Strategic Evaluation and Control, Techniques for Strategic Evaluation and Control, Role of Organizational Systems in Evaluation, McKinsey's 7s Framework.

Suggested Readings:

- Business Policy and Strategic Management by Azhar Kazmi, Tata McGraw-Hill, New Delhi.
- Strategic Management and Business Policy by Wheelen and Hunger, Pearson Education.
- Strategic Management by Chandrasekharan, Oxford University Press.
- Crafting and Executing Strategy: The Quest for Competitive Advantage by A. Thompson Jr., A. J. Strickland III, and J. E. Gamble, Tata McGraw-Hill.
- Strategic Management: Concepts and Cases by Fred R. David, Pearson Education.
- Strategic Management: Competitiveness and Globalization by M. A. Hitt, R. D. Ireland, and R. E. Hoskisson, Thomson Asia Pvt. Ltd.
- Strategic Management: Strategy Formulation and Implementation by J. A. Pearce II and R. B. Robinson Jr., AITBS Publishers and Distributors, Delhi.
- Management Policy and Strategic Management: Concepts, Skills and Practices by R. M. Srivastava, Himalayan Publishing House.
- Managing in a Time of Great Change by Peter F. Drucker, Truman Talley Books / Plume, Penguin Group.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Strategic Management Process	https://nptel.ac.in/courses/110108047
	Environment Appraisal	https://nptel.ac.in/courses/110107509
Unit-II	Corporate Level and Business Level Strategies	https://nptel.ac.in/courses/110105161
Unit-III	Strategy Implementation	https://nptel.ac.in/courses/122105024
	Case Study	https://nptel.ac.in/courses/122105024
Unit-IV	McKinsey's 7s Framework	https://nptel.ac.in/courses/110108161

Course Code	**MICV-309A**				
Category	Major Discipline Relevant Course (Vocational)- Minor				
Course Title	**Computer Networks and Internet**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are 1. To understand the fundamental concepts of computer networks, data communication components, network models (OSI & TCP/IP), and transmission media. 2. To explain and analyze the functions of Data Link, Network, Transport, and Application layers, including framing, error and flow control, MAC protocols, IP addressing, routing techniques, and protocols such as TCP, UDP, DNS, HTTP, FTP, and SMTP. 3. To explore and evaluate the structure of the Internet and World Wide Web, along with network security concepts, cryptographic techniques, and emerging technologies such as wireless networks, IoT, and cloud computing.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Recall** basic concepts of computer networks, models, and transmission media.	Level-1 Remember
CO2	**Explain** networking layers, protocols, and communication techniques.	Level-2 Understand
CO3	**Apply** networking concepts to examine routing, error control, and internet services.	Level-3 Apply
CO4	**Analyze** network security issues and modern networking technologies.	Level-4 Analyze

Note: Examiner will set nine questions in total. Question one will have 5 short questions of 2 marks (each) from all units. Remaining eight questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	**Contents**
Unit-I	**Introduction to Computer Networks:** Definition and importance of computer networks, Data communication concepts, Components, data flow, transmission modes, Types of networks (LAN, MAN, WAN, PAN), Network topologies, Bus, Star, Ring, Mesh, Hybrid, OSI Reference Model, Layers, functions, and services, TCP/IP Model, Architecture and comparison with OSI model, Transmission media, Guided (Twisted Pair, Coaxial, Optical Fiber) and Unguided (Radio waves, Microwave, Satellite).
Unit-II	**Data Link and Network Layer:** Data Link Layer Functions and services, Framing techniques: Character count, byte stuffing, bit stuffing**,** Error detection and correction: Parity, CRC, Hamming Code**,** Flow control protocols: Stop-and-Wait, Sliding Window**,** Medium Access Control: ALOHA, CSMA/CD, CSMA/CA. **Network Layer:** Logical addressing: IPv4 and IPv6, Subnetting and Supernetting. **Routing algorithms:** Distance Vector, Link State, Routing protocols, RIP, OSPF, BGP,

	Congestion control techniques.
Unit-III	**Transport Layer:** Functions and services, Connection-oriented vs Connectionless services, TCP vs UDP (features and comparison), Flow control and congestion control in TCP. **Application Layer:** Domain Name System (DNS), Hypertext Transfer Protocol (HTTP/HTTPS), File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), Telnet and SSH.
Unit-IV	**Internet fundamentals:** Structure, ISP, Internet services, World Wide Web (WWW): Working and architecture, Web browsers and search engines. **Network security concepts:** Threats, attacks, vulnerabilities Cryptography basics (Symmetric & Asymmetric encryption), Firewalls and Intrusion Detection Systems. **Emerging trends:** Wireless networks (Wi-Fi, Bluetooth), Mobile communication (3G, 4G, 5G basics), Internet of Things (IoT), Cloud computing basics.

Suggested Readings:

- Behrouz A. Forouzan, Data Communications and Networking, 5th ed., McGraw-Hill Education, 2013.
- Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, 5th ed., Pearson Education, 2010.
- James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, 8th ed., Pearson Education, 2021.
- William Stallings, Data and Computer Communications, 10th ed., Pearson Education, 2013.
- Nader F. Mir, Computer and Communication Networks, 2nd ed., Pearson Education, 2014.
- Douglas E. Comer, Internetworking with TCP/IP, Vol. 1, 6th ed., Pearson Education, 2014.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Network basics, OSI model, TCP/IP model, Topologies	https://nptel.ac.in/courses/106106091
Unit-II	Framing, Error detection (CRC, Hamming), Flow control, MAC protocols (ALOHA, CSMA/CD), Routing algorithms, IP addressing	https://nptel.ac.in/courses/106105081
Unit-III	TCP vs UDP, Congestion control, DNS, HTTP, FTP, SMTP, Application layer protocols	https://nptel.ac.in/courses/106105183
Unit-IV	Internet Technology	https://nptel.ac.in/courses/106105084
	Cryptography and Network Security	https://nptel.ac.in/courses/106105031
	Wireless Communication	https://nptel.ac.in/courses/108102096
	Cloud Computing	https://nptel.ac.in/courses/106105167

Course Code	**LC-MICV-311A**				
Category	Major Discipline Relevant Course (Vocational)- Minor				
Course Title	Computer Networks and Internet Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are to 1. To apply fundamental networking concepts to design and simulate network topologies, IP addressing, and communication. 2. To analyze data communication techniques such as framing, error detection, and flow control protocols. 3. To evaluate and create network applications using client-server programming, protocol analysis, and basic network security configurations.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	**Apply** networking concepts to implement topologies, IP addressing, and simulations.
CO2	**Analyze** framing, error detection, and flow control techniques.
CO3	**Evaluate** transport and application layer protocols using programming and tools.
CO4	**Create** network solutions using socket programming, routing, and security configurations.

Exp. No.	Contents
1	Study different types of networks (LAN, MAN, WAN, PAN) with real-life examples.
2	Implement basic network topologies (Bus, Star, Ring) using Cisco Packet Tracer.
3	Create and analyze Star topology and test communication between nodes.
4	Compare different transmission media (Twisted Pair, Coaxial, Optical Fiber) using charts or simulation.
5	Study OSI Model layers and map real-world protocols to each layer.
6	Implement framing techniques (Character count / Byte stuffing) using C program.
7	Write a program for error detection techniques using Parity Bit and CRC.
8	Implement Hamming Code for error detection and correction.
9	Simulate flow control protocols: Stop-and-Wait and Sliding Window.
10	Perform IP addressing and subnetting calculations manually.
11	Configure IPv4 addressing and test connectivity using ping command.
12	Study and simulate routing algorithms (Distance Vector, Link State).
13	Compare TCP and UDP using a simple client-server program.
14	Create a basic client-server communication using sockets in C/Python.
15	Study Application layer and security concepts: • DNS lookup using nslookup • HTTP working using browser developer tools • WWW request-response cycle • Basic firewall / packet filtering (simulation)

Course Code	**DSC-BBA-302A**				
Category	Discipline Specific Course - Major Course				
Course Title	**Research Methodology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand the fundamental concepts, nature, scope, and importance of research methodology in business decision-making. 2. To develop knowledge of research design, sampling techniques, and measurement methods for effective research planning. 3. To understand various methods of data collection, analysis, and hypothesis testing in research. 4. To gain insights into advanced analytical techniques and develop skills for research report writing and documentation.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, nature, scope, processes, and theoretical foundations of business research.	Level-1 Remember
CO2	**Describe** research designs, sampling methods, measurement techniques, data collection methods, and hypothesis testing procedures used in business research.	Level-2 Understand
CO3	**Apply** research methodologies, scaling techniques, data collection tools, and statistical methods for conducting business research and data analysis.	Level-3 Apply
CO4	**Analyze** research data using parametric and non-parametric techniques, multivariate methods, and research reporting practices for managerial decision-making.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.
2. At least four cases will be discussed, one from each unit.

Unit No.	Contents
Unit-I	**Business research:-** its concept, nature, scope, need and managerial value of business research; components of theory – definitions, concepts, constructs, variables, hypothesis, process of research and structure of research proposal.

Unit-II	**Research design:**- concept and types- exploratory, descriptive, diagnostic and experimental; sampling design; techniques, factors influencing sample size, measurement- concept, measurement scales- types and construction of scales and reliability and validity aspects in measurement.
Unit-III	**Methods of data collection:**– questionnaire/ schedule; questionnaire designing, interview and observational methods; data analysis and interpretation, editing, coding, content analysis and tabulation; hypothesis testing- an overview of parametric and non-parametric tests (Analysis of Variance, X test, Wilcoxon Matched- pair signed-rank test, Mann- Whitney test, Kruskal- Wallis H-test).
Unit-IV	**An overview of dependent and interdependent methods:-** Multiple regression, discriminant analysis, conjoint analysis, factor analysis, cluster analysis; ingredients and constructions of research report; procedure of preparation of reference and bibliography.

Suggested Readings:

- Business Research Methods by Naval Bajpai, Pearson Education
- Business Research Methods by Zikmund, Millian G., Thomson Learning, Bombay
- Business Research Methods by Cooper, Donald R- and Pamels Schindler Tata McGraw Hills, New Delhi
- Methods in Research by Geode, Millian J. and Paul K. Hatl, McGraw Hills, New Delhi
- Business Research Methods by Sekran, Uma, Miley Education, Singapore
- Research Methodology by Kothari, C.R.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Business research concept	http://www.digimat.in/nptel/courses/video/110107075/L01.html
Unit-II	Research design types	http://www.digimat.in/nptel/courses/video/110107075/L08.html
Unit-III	Parametric & non-parametric tests	http://www.digimat.in/nptel/courses/video/110107075/L20.html
Unit-IV	Regression, factor analysis	http://www.digimat.in/nptel/courses/video/110107075/L30.html

Course Code	**DSC-BBA-304A**				
Category	Discipline Specific Course - Major Course				
Course Title	**Event Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	1	**4**	
Course Objectives	The objectives of this course are: 1. To understand the fundamental concepts, scope, and significance of event management as a tool for marketing and communication. 2. To understand the key elements involved in planning and organizing events, including infrastructure, audience, and media. 3. To understand event positioning, pricing strategies, and promotional techniques in event management. 4. To understand strategic planning, performance evaluation, and control mechanisms in event management.				
End Semester Examination	50 Marks				
Practical/Viva-Voce	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, scope, characteristics, and significance of event management and events as marketing tools.	Level-1 Remember
CO2	**Explain** event elements, target audience, market segmentation, event positioning, pricing methods, and management functions in event planning.	Level-2 Understand
CO3	**Apply** event management principles for planning, organizing, promoting, pricing, and managing events in different business and marketing contexts.	Level-3 Apply
CO4	**Analyze** strategic event planning, market opportunities, competitive environments, and event performance evaluation for effective event management.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 5 short questions of 2 marks (each) from all units. Remaining eight questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.
2. At least four cases will be discussed, one from each unit.

Unit No.	Contents
Unit-I	**Events: –** Nature, definition and scope, C's of events, designing, interaction and importance; As a marketing tool – various needs addressed by events, focusing and implementing events, advantages and disadvantages of events.
Unit-II	**Elements of Events: –** Event, infrastructure, target audience, organizers, venue, media activities to be carried out; concept of market in events, segmentation and targeting of the market events.
Unit-III	**Event Positioning, Pricing and Management Functions: -**Positioning in events and the concept of event property; events as a product, methods of pricing events, events and promotion, various functions of management in events.
Unit-IV	**Strategic Planning and Event Performance Evaluation: -**Strategic alternatives arising from environment, competition and defined objectives; pricing objectives; evaluation of event

	performance – measuring performance and correcting deviations.

Suggested Readings:

- Event Marketing Management by Gaur, S.S. and Saggere, S.V.
- Marketing in the New Era by Panwar, J.S., Sage Publications, 1998
- Marketing Management, Analysis, Planning, Implementation and Control by Kotler, P., Prentice Hall, 1997
- Event and Entertainment by Avrich, Barry, Delhi, Vision Books, 1994

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Events – Nature, Scope & Marketing Role	https://nptel.ac.in/courses/110107145
Unit-II	Elements of Events & Market Segmentation	https://nptel.ac.in/courses/110105046
Unit-III	Positioning, Pricing & Promotion in Events	https://nptel.ac.in/courses/110107145
Unit-IV	Strategy & Performance Evaluation in Events	https://nptel.ac.in/courses/110105039

Course Code	**DSC-BBA-306A**				
Category	Discipline Specific Course - Major Course				
Course Title	**Financial Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	**4**	
Course Objectives	The objectives of this course are: 1. To understand the scope, objectives, and core functions of financial management along with the concept of time value of money and sources of finance. 2. To understand investment decision-making techniques, capital budgeting methods, and cost of capital concepts. 3. To analyze capital structure decisions, leverage, and dividend policies using theoretical models. 4. To understand working capital management, including cash, inventory, and receivables management for efficient financial operations.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Describe** the concepts, objectives, functions, and importance of financial management, time value of money, and sources of finance.	Level-1 Remember
CO2	**Explain** investment decisions, capital budgeting methods, cost of capital, capital structure theories, dividend policies, and working capital management.	Level-2 Understand
CO3	**Apply** financial management techniques for investment appraisal, cost of capital computation, leverage analysis, dividend decisions, and working capital management.	Level-3 Apply
CO4	**Analyze** financing, investment, capital structure, dividend, and working capital decisions for effective financial planning and organizational performance.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.
2. At least four cases will be discussed, one from each unit.

Unit No.	Contents
Unit-I	**Financial Management: -** Scope Finance Functions and Its Organization, Objectives of Financial Management; Time Value of Money; Sources of Long-Term Finance.
Unit-II	**Investment Decisions: -** Importance, Difficulties, Determining Cash Flows, Methods of Capital Budgeting; Risk Analysis (Risk Adjusted Discount Rate Method and Certainty Equivalent Method); Cost of Different Sources of Raising Capital; Weighted Average Cost of Capital.

Unit-III	**Capital Structure Decisions: -**Financial and Operating Leverage; Capital Structure Theories - NI, NOI, Traditional and MM Theories; Determinants of Dividend Policy and Dividend Models -Walter, Gordon and MM Models.
Unit-IV	**Working Capital: -** Meaning, Need, Determinants; Estimation of Working Capital Need; Management of Cash, Inventory and Receivables.

Suggested Readings:

- Pandy, I.M., Financial Management, Vikas Publishing House, New Delhi
- Khan M.Y, and Jain P.K., Financial Management, Tata McGraw Hill, New Delhi
- Berk, De Marzo, Harford, Fundamental of Corporate Finance, Pearson Education.
- Chandra, Prasanna, Financial Management, TMH, New Delhi
- Van Horne, James C., Financial Management and Policy, Pearson Education
- Brigham and Houston, Fundamentals of Financial Management, Thomson Learning, Bombay.
- Kishore, R., Financial Management, Taxman's Publishing House, New Delhi

Useful Video Links:

Unit No	Topics	Links
Unit-I	Finance functions, objectives	http://www.digimat.in/nptel/courses/video/110107144/L01.html
Unit-II	Capital budgeting	http://www.digimat.in/nptel/courses/video/110107144/L14.html
Unit-III	Leverage, capital structure theories, dividend models	http://www.digimat.in/nptel/courses/video/110107144/L24.html
Unit-IV	Cash, inventory, receivables management	http://www.digimat.in/nptel/courses/video/110107144/L34.html

Course Code	**DSC-BBA-308A**				
Category	Discipline Specific Course - Major Course				
Course Title	**Operations and Supply Chain Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	**4**	
Course Objectives	The objectives of this course are: 1. To understand the fundamental concepts, scope, and strategic role of operations and supply chain management in organizations. 2. To develop the knowledge of forecasting techniques, process design, capacity planning, and facility decisions in operations management. 3. To understand supply chain dynamics, logistics, procurement, and inventory management for efficient business operations. 4. To analyze performance measurement, customer value creation, and emerging trends in supply chain management.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, functions, strategies, and processes of operations and supply chain management.	Level-1 Remember
CO2	**Explain** forecasting methods, capacity planning, facility location and layout, quality management, logistics, procurement, and inventory management practices	Level-2 Understand
CO3	**Apply** operations and supply chain management techniques for forecasting, process design, capacity planning, quality improvement, logistics, procurement, and inventory control.	Level-3 Apply
CO4	**Analyze** operational decisions, supply chain performance, sourcing strategies, logistics systems, and customer value creation for organizational effectiveness.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.
2. At least four cases will be discussed, one from each unit.

Unit No.	Contents
Unit-I	**Fundamentals of Operations Management and Forecasting: -**Introduction to Operations Management; Factors affecting Operations Management, Decision making in Operations Management; Operation strategies; Demand Forecasting, Qualitative & Quantitative Forecasting methods; Designing of processes and Types of Process. Career Opportunities in Supply Chain Management and Skills Required for Success in Logistics and Operations Careers. Contemporary concepts in Operations and Supply Chain Management.

Unit-II	**Capacity Planning, Facility Location, Layout and Quality Management: -**Facility Capacity; Capacity Strategies; evaluation of capacity alternatives; analyzing capacity planning decisions; facility location; Factors, types and location planning methods, facility layout; Operation facility layout; types and layout decision models, Material Handling, Managing Quality, JIT and Lean production in operations management.
Unit-III	**Supply Chain Management and Logistics: -**Introduction to supply chain management; future trends in supply chain management; increasing supply chain responsiveness, Logistics; logistical operation in supply chain management, Supply chain synchronization, model and data validation, Decision Models, Logistic design and operational planning, managing operations across the supply chain.
Unit-IV	**Procurement, Inventory and Supply Chain Performance:-** Procurement Process and sourcing decision; procurement process perspective, strategies & trends in procurement, The sourcing decision and strategies, E-Procurement, risk and benefits of outsourcing. Inventory: role and importance in supply chain Management. Customer value and supply chain Management, performance measurement along the supply chain, social issues, & Relationship development in S. C. M.

Suggested Readings:

- Introduction to Operations and Supply Chain Management by Bozarth, Cecil C. & Handfield, Robert B.;
  Pearson Education; New Delhi
- Principles of Supply Chain Management – A balanced approach by Wisner, Joel D., Leong, G. Keong & Tan, Keah-Choon; Thomson Learning; New Delhi
- Operations Management by Gaither, Norman & Frazier, Greg; Thomson Learning; New Delhi
- Operations Management – Theory and Practice by Mahadevan, B.; Pearson Education; New Delhi
- Operations Management – Processes and Value Chains by Krajewski, Lee J. & Ritzman, Larry P.; Pearson
  Education; New Delhi

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Demand Forecasting Techniques	http://www.digimat.in/nptel/courses/video/110107141/L10.html
Unit-II	Capacity Planning and Facility Location	http://www.digimat.in/nptel/courses/video/110107141/L18.html
Unit-III	Introduction to Supply Chain Management	http://www.digimat.in/nptel/courses/video/110107141/L30.html
Unit-IV	Procurement and Sourcing Strategies	http://www.digimat.in/nptel/courses/video/110107141/L40.html

Course Code	**MICV- 308A**				
Category	Major Discipline Relevant Course (Vocational) – Minor				
Course Title	Entrepreneurship Development				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand the fundamental concepts, theories, and role of entrepreneurship in economic development. 2. To develop the ability to identify business opportunities through creative thinking and feasibility analysis. 3. To equip students with skills to design functional plans including organizational, financial, and operational aspects of a venture. 4. To understand various sources of finance and legal aspects including Intellectual Property Rights (IPR) relevant to entrepreneurship.				
Assessment	30 Marks				
End Semester Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, theories, characteristics, and significance of entrepreneurship and entrepreneurial environment in India.	Level-1 Remember
CO2	**Explain** business opportunity identification, feasibility analysis, business planning, financial planning, and sources of entrepreneurial finance**.**	Level-2 Understand
CO3	**Apply** entrepreneurial skills and business planning techniques for venture creation, organizational design, financial planning, and business decision-making.	Level-3 Apply
CO4	**Analyze** entrepreneurial opportunities, environmental factors, financial viability, organizational design, and various financing options.	Level-4 Analyze

Note:

Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Entrepreneurship:-** Concept, theories, process, Growth of entrepreneurship environment in India, Traits of successful entrepreneurs; Managerial vs. entrepreneurial approach.
Unit-II	**Starting the venture:**-Creative thinking, Business idea generation (Business cases on entrepreneurship), Environmental scanning pertaining to business idea: Feasibility study: Market feasibility, Technical/ Feasibility operations, financial feasibility, Project Report.

Unit-III	**Functional Plans:-** Drawing a business plan, selecting organization type for business, Organization structure and Job designs, Designing financial plan: Investment, Incomes and Expenditure, Banking and Accounts, understanding profitability.
Unit-IV	**Sources of Finance:-** understanding Financial Framework: Debt Equity Financing, Commercial banks, Venture Capital, Financial institutions supporting entrepreneurs, Angel investors. Understanding IPR: Patents, Trademarks, Copy rights, Trade secrets, Licensing, Franchising.

Suggested Readings:

- Entrepreneurship Development & Small Business Enterprises by Charantimath, Poornima, , Pearson Education.
- Entrepreneurship by Hisrich, Robert D., Michael Peters and Dean Shephered, Tata McGraw Hill, New Delhi
- Entrepreneurship by Barringer, Brace R., and R. Duane Ireland, Pearson Education.
- Entrepreneurship by Lall, Madhurima, and Shikha Sahai, Excel Books, New Delhi.
- Entrepreneurship by Kuratko, Donand and Richard Hodgetts, Cengage Learning India Pvt. Ltd., New Delhi

Useful Video Links:

Unit No	Topics	Links
Unit-I	Entrepreneurship Concepts & Environment	https://nptel.ac.in/courses/110106141
Unit-II	Starting the Venture & Feasibility Study	https://nptel.ac.in/courses/110106141/lecture-05
Unit-III	Functional Plans & Business Plan	https://nptel.ac.in/courses/110106141/lecture-12
Unit-IV	Sources of Finance & IPR	https://nptel.ac.in/courses/110105139

Course Code	**MICV-310A**				
Category	Major Discipline Relevant Course (Vocational)- Minor				
Course Title	**Web Development**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are 1. To provide fundamental knowledge of web technologies, Internet concepts, HTML, CSS, and JavaScript for web page development. 2. To develop understanding of web page designing, styling techniques, and client-side scripting used in modern websites. 3. To apply and analyze basic web development concepts for creating simple, responsive, and interactive web pages.				
Assessment	25 Marks				
End Semester Examination	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** concepts of web technology, HTML, CSS, JavaScript, websites, web pages, and web development tools.	Level-1 Remember
CO2	**Explain** HTML tags, web page structure, CSS styling techniques, and basic JavaScript concepts used in web development.	Level-2 Understand
CO3	**Apply** HTML, CSS, and JavaScript techniques to create and design simple web pages and forms.	Level-3 Apply
CO4	**Analyze** web page structure, styling methods, responsive layouts, and client-side scripting techniques for web applications.	Level-4 Analyze

Note:
Examiner will set nine questions in total. Question one will have 5 short questions of 2 marks (each) from all units. Remaining eight questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Basics of Web Technology:-** Introduction to Internet, World Wide Web (WWW), Web Browsers, Web Servers, Websites and Web Pages, Static and Dynamic Websites, URL and Domain Name, Web Hosting Basics, Client Server Architecture, Introduction to Web Development Tools and Editors.
Unit-II	**HTML Basics:-** Introduction to HTML, Structure of HTML Document, Basic HTML Tags, Heading and Paragraph Tags, Text Formatting Tags, Lists in HTML, Hyperlinks, Images, Tables, Frames, Forms and Form Controls, HTML Attributes, Introduction to HTML5.
Unit-III	**Advanced HTML and CSS:-** HTML5 Audio and Video Tags, Semantic Tags, Introduction to CSS, Types of CSS, CSS Selectors, Colors, Backgrounds, Fonts, Borders, Margins and Padding, CSS Box Model, Styling Tables and Forms, Introduction to Responsive Web Pages.

Unit-IV	**CSS and JavaScript Basics:** CSS Positioning and Layout, Navigation Bar Design using CSS, Introduction to JavaScript, Variables and Data Types, Operators, Conditional Statements, Looping Statements, Functions, Arrays, Event Handling, Form Validation using JavaScript, Introduction to DOM.

Suggested Readings:

- Web Technologies by Uttam K. Roy, Oxford University Press, 2011.
- HTML and CSS: Design and Build Websites by Jon Duckett, Wiley India, 2017.
- Web Programming by Chris Bates, Wiley Dreamtech, 2009.
- Internet and Web Technology by Raj Kamal, Tata McGraw Hill, 2007.
- Programming the World Wide Web by Robert W. Sebesta, Pearson Education, 2016.
- Beginning HTML, XHTML, CSS and JavaScript by Jon Duckett, Wiley Publications, 2010.
- JavaScript: The Complete Reference by Thomas A. Powell and Fritz Schneider, McGraw Hill, 2013.
- Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP by Ivan Bayross, BPB Publications, 2010.
- Learning Web Design by Jennifer Niederst Robbins, O'Reilly Media, 2018.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Internet	https://nptel.ac.in/courses/106105082
	World Wide Web (WWW), Web Browsers	https://nptel.ac.in/courses/106105084
Unit-II	HTML	https://www.youtube.com/watch?v=QEtWL4lWlL4&t=984s
Unit-III	CSS	https://www.youtube.com/watch?v=QEtWL4lWlL4&t=984s
Unit-IV	Java Script	https://www.youtube.com/watch?v=uUhOEj4z8Fo&t=568s

Course Code	**LC-MICV-312A**				
Category	Major Discipline Relevant Course (Vocational)- Minor				
Course Title	Web Development Lab				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI**
	0	0	2	**1**	
Course Objectives	The objectives of this course are to 1. To develop practical skills in creating web pages using HTML elements, forms, tables, multimedia, and semantic tags. 2. To analyze and apply CSS styling, responsive layouts, and JavaScript functionalities for interactive web page design. 3. To design and develop simple responsive websites using HTML, CSS, and JavaScript technologies.				
Assessment	10 Marks				
End Semester Practical Examination	15 Marks				
Total Marks	25 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	**Apply** HTML, CSS, and JavaScript concepts to create and design basic web pages and forms.
CO2	**Analyze** web page structures, CSS layouts, responsive design techniques, and client-side scripting functionalities.
CO3	**Evaluate** web page design, styling methods, and JavaScript validation techniques for effective web development.
CO4	**Design** and develop responsive and interactive websites using HTML, CSS, and JavaScript technologies.

Exp. No.	Contents
1	Study of Internet, web browsers, web servers, and website structure.
2	Create a simple web page using basic HTML tags.
3	Design a web page using text formatting tags, lists, and hyperlinks.
4	Create web pages using images, tables, and frames in HTML.
5	Design HTML forms using different form controls.
6	Create web pages using HTML5 semantic tags.
7	Implement audio and video embedding in HTML5 web pages.
8	Apply internal, external, and inline CSS in web pages.
9	Design web pages using CSS colors, fonts, borders, margins, and padding.
10	Create responsive web pages using CSS layout and positioning techniques.
11	Design navigation bars and styled forms using CSS.
12	Implement JavaScript variables, operators, and control statements.
13	Develop programs using JavaScript functions and arrays.
14	Implement event handling and form validation using JavaScript.
15	Design and develop a simple responsive website using HTML, CSS, and JavaScript.

Annexure AC/ 5.44

~~Annexure 4.4~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

Approved by AICTE, New Delhi and Affiliated to MDU, Rohtak

NAAC 'A' GRADE

SCHEME OF EXAMINATIONS AND SYLLABI

OF

3-4 YEARS

BACHELOR OF BUSINESS ADMINISTRATION PROGRAM

(BBA)

WITH EFFECT FROMTHE

SESSION 2026-27

1st Semester onwards (Students Admitted in 2026-27)

&

3rd Semester onwards (Students Admitted in 2025-26)

BACHELOR OF BUSINESS ADMINISTRATION (BBA)

BBA / BBA (Honours) / BBA (Honours with Research)

Program Overview

The Bachelor of Business Administration (BBA) is a comprehensive 3-year undergraduate program, extendable to 4 years for Honours/Honours with Research, designed as per NEP-2020 and AICTE Model Curriculum. This program provides flexible entry and exits options, industry-oriented skill development, and multi-disciplinary learning through core courses, electives, skill enhancement modules, value-added courses, and research projects.

BBA Program Objectives and Outcomes

The BBA Program aims to develop competent, ethical, and visionary business leaders who can contribute meaningfully to national progress and excel in the global business environment. The following Program Objectives and Outcomes reflect our commitment to academic excellence, leadership development, and holistic personality growth.

Program Objectives

1. Acquire and demonstrate comprehensive theoretical and practical knowledge of management and business, with the ability to critically analyze Indian and global business environments and apply insights across diverse contexts.
2. Cultivate the mindset to act as responsible managers, entrepreneurs, and leaders, integrating knowledge and skills to contribute meaningfully to national development and to act as responsible global citizens.
3. Demonstrate effective communication skills to present opinions, ideas, and strategies with clarity, logical reasoning, and critical thinking.
4. Develop the ability to understand, articulate, and navigate complex business environments with mindfulness and strategic clarity.
5. Exhibit commitment to roles and responsibilities as active members of multi-cultural teams, effectively managing diversity in cross-cultural settings.
6. Uphold the highest standards of professional and ethical conduct, fostering trust and integrity in all business practices.
7. Evolve into emotionally intelligent leaders and informed decision-makers, capable of inspiring and motivating teams to achieve organizational goals.
8. Strengthen problem-solving capabilities and decision-making acumen to provide innovative and effective business solutions.
9. Build research and analytical skills to explore, understand, and critically evaluate both Indian and global business environments.

Program Outcomes

The program provides multiple entry and exits points in alignment with NEP-2020, enabling students to earn a Certificate, Diploma, Degree, or Honours Degree with Research, progressively enhancing their knowledge and skills.

At the End of First Year: UG Certificate in Business Administration

1. Understand and conceptualize the foundational principles and theories of management.
2. Recognize the importance of effective communication for presenting ideas and opinions in professional settings.
3. Demonstrate the ability to comprehend and describe the business environment and its dynamics.
4. Apply logical thinking and data interpretation skills to identify and analyse basic business problems.

At the End of Second Year: UG Diploma in Business Administration

1. Demonstrate intermediate level understanding of management concepts along with basic managerial and analytical skills.
2. Apply effective communication and logical reasoning in business decision-making and collaborative environments.
3. Exhibit professional conduct and appreciate workplace ethics and responsibilities.
4. Work effectively in team settings, embracing the value of group work and collaborative problem solving.
5. Develop creativity and innovative thinking to approach business challenges.

At the End of Third Year: Bachelor of Business Administration (BBA)

1. Exhibit comprehensive factual and theoretical knowledge of management and business functions.
2. Critically evaluate and analyze Indian and global business environments across multiple contexts.
3. Recognize and perform roles as managers, entrepreneurs, and leaders in diverse business scenarios.
4. Communicate effectively using critical thinking, logical reasoning, and structured analysis.
5. Demonstrate consistent adherence to professional and ethical standards in managerial practices.

At the End of Fourth Year: BBA (Honours) / BBA (Honours with Research)

1. Integrate advanced theoretical and practical knowledge of management to critically analyze and respond to Indian and global business challenges.
2. Articulate and evaluate business strategies with clarity, mindfulness, and a holistic perspective.
3. Demonstrate leadership, accountability, and effective participation as members of multicultural and diverse teams.
4. Exhibit emotional intelligence, strategic decision-making, and the ability to motivate and influence teams.
5. Apply problem-solving and analytical skills to deliver innovative solutions and support informed managerial decisions.
6. Develop advanced research and inquiry skills to conduct in-depth studies of Indian and global business environments, contributing to new knowledge creation.

Exit Options as per NEP-2020:

1. After 1 Year: UG Certificate in Business Administration
2. After 2 Years: UG Diploma in Business Administration
3. After 3 Years: BBA Degree
4. After 4 Years: BBA (Honours) / BBA (Honours with Research)

Eligibility for 4th Year Admission:

Minimum eligibility criteria for opting the course in the fourth year will be as follows:

- **For BBA (Honours):** Completion of 3-Year BBA Degree
- **BBA (Honours with Research):** Minimum 75% marks or equivalent CGPA in BBA Degree up to Sixth Semester.

Note: The students who are eligible for BBA (Honours with Research) shall have the choice to pursue either BBA (Honours) or BBA (Honours with Research).

Credit System and Course Codes

Definition of Credit:

- 1 Hour Lecture (L) per week = 1 Credit
- 1 Hour Tutorial (T) per week = 1 Credit
- 1 Hour Practical (P) per week = 0.5 Credit
- 2 Hours Practical (P) per week = 1 Credit

Course Code and Components:

- L – Lecture
- T – Tutorial
- P – Practical
- CC – Core Course
- AEC – Ability Enhancement Course
- MDE – Multi-Disciplinary Elective Course
- VAC – Value Added Course
- SEC – Skill Enhancement Course
- LC – Lab Course
- INT– Summer Internship Report/ Capstone Project
- RP– Project Report/Research Project/Dissertation
- DSE – Discipline Specific Elective (Human Resource Management/ Business Analytics/ Marketing/ Supply Chain Management/ Finance/ International Business)
- OE – Open Elective (SWAYAM / Other Department Courses)

SEMESTER-WISE CREDIT DISTRIBUTION

Semester-Wise Credit Distribution of the proposed BBA, BBA (Honours) and BBA (Honours with Research) Program

Semester	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective Course	Value Added Courses	Skill Enhancement Courses	Discipline Specific Elective	Total
I	12	4	2	2	-	-	20
II	12	2	2	2	2	-	20
III	12	-	2	2	4	-	20
IV	16	-	-	2	2	-	20
V	8	-	-	-	4	8	20
VI	6	-	-	-	6	8	20
BBA (Honours)							
Semester	**Core Courses**	**Ability Enhancement Courses**	**Multi-Disciplinary Elective Course**	**Value Added Courses**	**Skill Enhancement Courses**	**Discipline Specific Elective**	**Total**
VII	4	-	4	-	4	8	20
VIII	-	-	-	-	8	12	20
BBA (Honours with Research)							
Semester	**Core Courses**	**Ability Enhancement Courses**	**Multi-Disciplinary Elective Course**	**Value Added Courses**	**Skill Enhancement Courses**	**Discipline Specific Elective**	**Total**
VII	12	-	-	-	-	8	20
VIII	20	-	-	-	-	-	20

Category-wise Distribution

Description	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective Course	Value Added Courses	Skill Enhancement Courses	Discipline Specific Elective	Total
BBA	66	6	6	8	18	16	120

BBA (Honours)	70	6	10	8	30	36	160
BBA (Honours with Research)	98	6	6	8	18	24	160
3 Years BBA Program					**Total Credits=120**		
4 Years BBA (Honours) and BBA (Honours with Research) Program					**Total Credits=160**		

Note: Students can take an extra credit course from their own department or from another department as per the Institute norms.

Induction Program (Mandatory)

A 3-week Student Induction Program has to be conducted at the start of the first year to familiarize students with the academic environment, develop soft skills, and promote holistic learning.

Components Include:

- Physical Activities & Fitness
- Creative Arts & Literary Activities
- Universal Human Values and Ethics
- Language & Proficiency Modules
- Expert Lectures – at least one per semester
- Industrial Visits – one per semester
- Orientation with Department, Branch, and Innovations

Mandatory Academic Activities

1. Industrial Visits: One per semester
2. Workshops: One-week professional/industry/entrepreneurial workshop after the 5th semester
3. Expert Lectures: At least one per semester by industry/domain experts

Summer Internship & Projects

Evaluation includes Work Done, Project Report, Presentation, and Viva-Voce

Internal Assessment Includes:

- Class Participation and Performance
- Attendance
- Assignments & Quizzes
- Lab Records & Practical Viva-Voce
- Mid-Semester Tests (Best 2 out of 3 considered)

Grading System

Each course (Theory/ Practical) is assigned 100 marks, irrespective of the number of credits.

Case Studies

Each core course should include four case studies, preferably one from each unit.

Scheme of Studies and Examination
BBA – 1st Semester (GITAM)
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical /Viva-Voce	Total
1	Core Course	CC-BBA-101B	Principles and Practices of Management	3	1	0	4	4	30	70	-	100
2	Core Course	CC-BBA-103B	Financial Accounting	3	1	0	4	4	30	70	-	100
3	Core Course	CC-BBA-105B	Business Statistics and Logic	3	1	0	4	4	30	70	-	100
4	Multidisciplinary Course	Refer Table No.- I	……	2	0	0	2	2	100	-	-	100
5	Ability Enhancement Course	AEC-BBA-105B	General English	1	1	0	2	2	30	70	-	100
6	Ability Enhancement Course	AEC-BBA-109B	Business Communication-I	1	1	0	2	2	30	70	-	100
7	Additional Course (Ability Enhancement Course)	AEC-BBA-107B	French (1-1-0)	-	-	-	-	No credit	100	-	-	100*
8	Value Added Course	VAC-BBA-101B	Environmental Science and Sustainability	2	0	0	2	2	100	-	-	100
Total Credits								**20**				**700**

Note:

1. The duration of all the end-term theory examinations shall be 3 hours.
2. The Criteria for awarding the formative assessment of 30 marks throughout the Program shall be as under:
   a) Sessional Examination: 50% of Assessment marks.
   b) Assignments/ Presentations/ Seminars and Class Participation: 30% of Assessment marks.
   c) Attendance: 20% of Assessment marks.
   (Less than 65% - 0% of Attendance marks; 65%-74.99% - 25% of Attendance marks; 75%-79.99% - 45% of Attendance marks; 80%-84.99% - 60% of Attendance marks; 85%-89.99% - 80% of Attendance marks; 90%-100% - 100% of Attendance marks)

The Criteria for awarding the Formative assessment of the practical course throughout the Program shall be as under:
   a) Practical Assignments/Practical File: 06 Marks (60% Weightage of Assessment)
   b) Attendance (Criteria as mentioned above in 2(c)) : 04 marks (40% Weightage of Assessment)

3. The panel of examiners for end-semester theory examinations shall be prepared and approved by the BOS, comprising internal and External examiners based on their expertise, specialization, and area of interest.
4. The formative assessment criteria for **Multi-Disciplinary Course** in Semester I will be as follows:

Sessional Test	30 Marks
Assignment/ Case Study/ Mini Project	30 Marks
Book Review/ Essay/ Seminar	15 Marks
Quiz/ Group Discussion/ Debate	20 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

5. The formative assessment criteria for **Value Added Course** in Semester I will be as follows:

Sessional Test	30 Marks
Class Assignment/ Case Study/ Mini Project	35 Marks
Quiz/ Seminar/ Group Discussion/ Debate	30 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

6. An '**Additional Course'** is a non-credit Ability-Enhancement Course that is undertaken for learning purposes only. If completed, the '**Additional Course'** may be recorded. The **Additional Course (Ability Enhancement Course)** is included as a qualifying paper and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

The formative assessment criteria for **Additional Course (Ability-Enhancement Course)** in Semester I will be as follows:

Sessional Test	30 Marks
Peer Discussion/ Debate/ Extempore Speech	40 Marks
Role Play	10 Marks
Essay/ Article/ Report Writing	15 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

Semester-I

Table No. I (Multidisciplinary Courses-Indian Knowledge System)

S. NO.	Category	Course Code	Course Name
1	Multidisciplinary Courses	MDE-BBA-101B	Indian Knowledge Systems and Traditions
2	Multidisciplinary Courses	MDE-BBA-103B	Indian Mathematics and Astronomy
3	Multidisciplinary Courses	MDE-BBA-105B	Indian Vision for Human Society
4	Multidisciplinary Courses	MDE-BBA-107B	Indian Culture and Civilization
5	Multidisciplinary Courses	MDE-BBA-109B	Indian Science, Engineering and Technology
6	Multidisciplinary Courses	MDE-BBA-111B	Indian Town Planning and Architecture
7	Multidisciplinary Courses	MDE-BBA-113B	Indian Health, Wellness and Psychology

Scheme of Studies and Examination
BBA – 2nd Semester (GITAM)
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical /Viva-Voce	Total
1	Core Course	CC-BBA-102B	Human Behaviour and Organization	3	1	0	4	4	30	70	-	100
2	Core Course	CC-BBA-104B	Marketing Management	3	1	0	4	4	30	70	-	100
3	Core Course	CC-BBA-106B	Business Economics	3	1	0	4	4	30	70	-	100
4	Multidisciplinary Course	MDE-BBA-108B	Media Literacy and Critical Thinking	1	1	0	2	2	100	-	-	100
5	Ability Enhancement Course	AEC-BBA-110B	Business Communication-II	1	1	0	2	2	30	70	-	100
6	Additional Course (Ability Enhancement Course)	AEC-BBA-108B	Hindi (1-1-0)	-	-	-	-	No credit	100	-	-	100*
7	Value Added Course	VAC-BBA-104B	Indian Constitution	2	0	0	2	2	100	-	-	100
8	Skill Enhancement Course	SEC-BBA-102B	Emerging Technologies and Applications (Theory)	1	0	0	1	1	20	50	-	100
			Emerging Technologies and Applications (Practical)	0	0	2	2	1	10	-	20	
Total Credits								**20**				**700**

Note:

1. The duration of all the end-term theory examinations shall be 3 hours.
2. The Criteria for awarding the formative assessment of 30 marks throughout the Program shall be as under:
   a) Sessional Examination: 50% of Assessment marks.
   b) Assignments/ Presentations/ Seminars and Class Participation: 30% of Assessment marks.
   c) Attendance: 20% of Assessment marks.
   (Less than 65% - 0% of Attendance marks; 65%-74.99% - 25% of Attendance marks; 75%-79.99% - 45% of Attendance marks; 80%-84.99% - 60% of Attendance marks; 85%-89.99% - 80% of Attendance marks; 90%-100% - 100% of Attendance marks)

   The Criteria for awarding the Formative assessment of the practical course throughout the Program shall be as under:
   a) Practical Assignments/Practical File: 06 Marks (60% Weightage of Assessment)
   b) Attendance (Criteria as mentioned above in 2(c)): 04 marks (40% Weightage of Assessment)
3. The panel of examiners for end-semester theory examinations shall be prepared and approved by the BOS, comprising internal and external Examiners based on their expertise, specialization, and area of interest.
4. The formative assessment criteria for **Multi-Disciplinary Course** in Semester II will be as follows:

Sessional Test	30 Marks
Assignment/ Case Study/ Mini Project	30 Marks
Book Review/ Essay/ Seminar	15 Marks
Quiz/ Group Discussion/ Debate	20 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

5. The formative assessment criteria for **Value Added Course** in Semester II will be as follows:

Sessional Test	30 Marks
Assignment/ Case Study/ Mini Project	35 Marks
Quiz/ Group Discussion/ Debate	30 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

6. An '**Additional Course**' is a non-credit Ability-Enhancement Course that is undertaken for learning purposes only. If completed, the

'**Additional Course'** may be recorded. The **Additional Course (Ability Enhancement Course)** is included as a qualifying paper and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

The formative assessment criteria for **Additional Course (Ability-Enhancement Course)** in Semester I will be as follows:

Sessional Test	30 Marks
Peer Discussion/ Debate/ Extempore Speech	40 Marks
Role Play	10 Marks
Essay/ Article/ Report Writing	15 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

7. Exit Criteria after First Year of BBA Program: The students shall have an option to exit after 1st year of Business Administration Program and will be awarded with a UG Certificate in Business Administration. Students on exit have to compulsorily complete additional 04 Credits either in a Skill based subject or work based Vocational Course offered during summer term or Internship/Apprenticeship / Social Responsibility & Community Engagement- encompassing community engagement with an NGO after the second semester of a minimum of 08 weeks of duration (online/offline/hybrid) as decided by the Institute. The exiting students will clear the subject / submit the Internship Report as per the Institute schedule.

Total Credits (20+20=40+4) for UG Certificate (Business Administration)	**44**

Re-entry Criteria into Second Year (Third Semester)

The student who takes an exit after one year with the award of a certificate may be allowed to re-enter in the third Semester for completion of the BBA Program as per the Institute's schedule after earning requisite credits in the First year.

Scheme of Studies and Examination
BBA – 3rd Semester
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical / Viva- Voce	Total
1	Core Course	CC-BBA-201B	Cost and Management Accounting	3	1	0	4	4	30	70	-	100
2	Core Course	CC-BBA-203B	Legal and Ethical Issues in Business	3	1	0	4	4	30	70	-	100
3	Core Course	CC-BBA-205B	Human Resource Management	3	1	0	4	4	30	70	-	100
4	Multi-Disciplinary Elective Course	MDE-BBA-201B	Indian Systems of Health and Wellness	1	1	0	2	2	100	-	-	100
5	Value Added Course	VAC-BBA-201B	Disaster Management	0	0	4	4	2	100	-	-	100
6	Skill Enhancement Course	SEC-BBA-201B	Management Information System (Theory)	2	0	0	2	2	20	50	-	100
			Management Information System (Practical)	0	0	4	4	2	10	-	20	
Total Credits								**20**				**600**

Note:

1. The duration of all the end-term theory examinations shall be 3 hours.
2. The Criteria for awarding the formative assessment of 30 marks throughout the Program shall be as under:
   a) Sessional Examination: 50% of Assessment marks.
   b) Assignments/ Presentations/ Seminars and Class Participation: 30% of Assessment marks.
   c) Attendance: 20% of Assessment marks.
   (Less than 65% - 0% of Attendance marks; 65%-74.99% - 25% of Attendance marks; 75%-79.99% - 45% of Attendance marks; 80%-84.99% - 60% of Attendance marks; 85%-89.99% - 80% of Attendance marks; 90%-100% - 100% of Attendance marks)

The Criteria for awarding the Formative assessment of the practical course throughout the Program shall be as under:

a) Practical Assignments/Practical File: 06 Marks (60% Weightage of Assessment)
b) Attendance (Criteria as mentioned above in 2(c)): 04 marks (40% Weightage of Assessment)

3. The panel of examiners for end-semester theory examinations shall be prepared and approved by the BOS, comprising internal and external examiners based on their expertise, specialization, and area of interest.
4. The formative assessment criteria for the **Multi-Disciplinary Course** in Semester III will be as follows:

Sessional Test	30 Marks
Assignment/ Case Study/ Mini Project	30 Marks
Book Review/ Essay/ Seminar	15 Marks
Quiz/ Group Discussion/ Debate	20 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

5. The formative assessment criteria for the **Value Added Course** in Semester III will be as follows:

Regular Assessment through observation and class discussion	40 Marks
Field Work (Report)/ Mini Project	30 Marks
Assignment	25 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

Scheme of Studies and Examination
BBA – 4th Semester
w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical / Viva-Voce	Total
1	Core Course	CC-BBA-202B	Entrepreneurship and Startup Ecosystem	1	1	0	2	2	30	70	-	100
2	Core Course	CC-BBA-204B	Operations Management	3	1	0	4	4	30	70	-	100
3	Core Course	CC-BBA-206B	Financial Management	3	1	0	4	4	30	70	-	100
4	Core Course	CC-BBA-208B	Business Research Methodology	3	1	0	4	4	30	70	-	100
5	Core Course	CC-BBA-210B	International Business	2	0	0	2	2	30	70	-	100
6	Value Added Course	VAC-BBA-202B	Business Environment and Public Policy	2	0	0	2	2	100	-	-	100
7	Skill Enhancement Course	SEC-BBA-202B	Design Thinking and Innovation	1	1	0	2	2	30	70	-	100
Total Credits								**20**				**700**

Note:

1. The duration of all the end-term theory examinations shall be 3 hours.
2. The Criteria for awarding the formative assessment of 30 marks throughout the Program shall be as under:
   a) Sessional Examination: 50% of Assessment marks.
   b) Assignments/ Presentations/ Seminars and Class Participation: 30% of Assessment marks.
   c) Attendance: 20% of Assessment marks.
   (Less than 65% - 0% of Attendance marks; 65%-74.99% - 25% of Attendance marks; 75%-79.99% - 45% of Attendance marks; 80%-84.99% - 60% of Attendance marks; 85%-89.99% - 80% of Attendance marks; 90%-100% - 100% of Attendance marks)

The Criteria for awarding the Formative assessment of the practical course throughout the Program shall be as under:

a) Practical Assignments/Practical File: 06 Marks (60% Weightage of Assessment)
b) Attendance (Criteria as mentioned above in 2(c)): 04 marks (40% Weightage of Assessment)

3. The panel of examiners for end-semester theory examinations shall be prepared and approved by the BOS, comprising internal and external examiners based on their expertise, specialization, and area of interest.
4. The formative assessment criteria for **Value Added Course** in Semester IV will be as follows:

Sessional Test	30 Marks
Class Assignment/ Case Study/ Mini Project	35 Marks
Quiz/ Seminar/ Group Discussion/ Debate	30 Marks
Attendance (Criteria as mentioned above in 2(c))	05 Marks

5. At the end of the Fourth Semester, every student shall undergo Summer Training/ Internship/ Capstone for 08 Weeks (online/offline/hybrid) in the industry/ Research or Academic Institute. This component will be evaluated during the fifth semester.
6. Exit Criteria after Second Year of BBA Program

The students shall have an option to exit after 2nd year of Business Administration Program and will be awarded with a UG Diploma in Business Administration. Students on exit have to compulsorily complete an additional 04 Credits either in a Skill-based subject or work based Vocational Course offered during the summer term or Internship/ Apprenticeship/ Social Responsibility & Community Engagement encompassing community engagement with an NGO/ Capstone Project after the fourth semester of a minimum of 8 weeks of duration as decided by the Institute (securing 84 credits).The exiting students will clear the subject/ submit the Internship Report as per the Institute schedule.

Total Credits (20+20+20+20=80+4) for UG Diploma (Business Administration)	**84**

Re-entry Criteria into Third Year (Fifth Semester)

The student who takes an exit after the second year with an award of Diploma may be allowed to re-enter into fifth Semester for completion of the BBA Program as per the University schedule after earning requisite credits in the Second year.

Scheme of Studies and Examination

BBA – 5th Semester

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical / Viva-Voce	Total
1	Core Course	CC-BBA-301B	Strategic Management	3	1	0	4	4	30	70	-	100
2	Core Course	CC-BBA-303B	Logistics and Supply Chain Management	3	1	0	4	4	30	70	-	100
3	Discipline Specific Elective	Table-I Discipline Specific Elective	Specialization-I (Course-1)	3	1	0	4	4	30	70	-	100
4	Discipline Specific Elective	Table-I Discipline Specific Elective	Specialization-II (Course-1)	3	1	0	4	4	30	70	-	100
5	Discipline Specific Elective	Table-I Discipline Specific Elective	Additional DSE (3-1-0) (Audit Course) *	-	-	-	-	No Credit	-	-	-	-
6	Internship	INT-BBA-301B	Summer Internship Report/Capstone Project	-	-	-	4	4	-	-	100	100
Total Credit								**20**				**500**

Note:

1. The duration of all the end-term theory examinations shall be 3 hours.
2. The Criteria for awarding the formative assessment of 30 marks throughout the Program shall be as under:
   a) Sessional Examination: 50% of Assessment marks.
   b) Assignments/ Presentations/ Seminars and Class Participation: 30% of Assessment marks.
   c) Attendance: 20% of Assessment marks.
   (Less than 65% - 0% of Attendance marks; 65%-74.99% - 25% of Attendance marks; 75%-79.99% - 45% of Attendance marks; 80%-84.99% - 60% of Attendance marks; 85%-89.99% - 80% of Attendance marks; 90%-100% - 100% of Attendance marks)
3. The panel of examiners for end-semester theory examinations shall be prepared and approved by the BOS, comprising internal and external examiners based on their expertise, specialization, and area of interest.
4. *An Audit Course is a non-credit course that is undertaken for learning purposes only. If successfully completed, the audit course may be recorded. Additional DSE is an Audit Course (Non-Credit but compulsory) to be opted by the student from the list of specializations offered other than the two specialisations chosen by her/ him.
5. Four credits of internship earned by a student during summer internship after the 2nd semester or 4th semester will be counted in the 5th semester of a student who pursues a 3-year UG Program without taking the exit option.
6. The criteria for Internship Evaluation will be as follows:

After completion of internship, students need to prepare a comprehensive report highlighting their learning and takeaways during the internship period. The internship report prepared after completion shall be assessed in the 5th semester as a compulsory course. The candidates will submit the internship report in the prescribed format designed by the department. The report shall be signed by the Internship Supervisor from respective Department and Mentor from the internship-providing organisations. Evaluation of internship report and viva-voce will be jointly conducted by the Internship Supervisor and Mentor on the time and date notified by the concerned HoD. The mentor from host organization may participate in the evaluation through online/ offline mode. In case of nonavailability of the respective mentor, the available relevant mentor as decided by the concerned head of the department, may be utilized for the purpose of evaluation.

Suggested distribution of marks will be as below:

Assessment by Mentor- 30 Marks (Skills learned- 15 Marks; Regularity- 10 Marks; Conduct- 5 Marks)

Internship Report - 40 Marks, Viva-Voce - 30 Marks

7. The student shall start working on the Major Project in this semester as per the guidelines. It will be evaluated in sixth semester as a compulsory paper.
8. Students are required to choose any two specialization areas offered under a dual specialization scheme from the given three groups, selecting not more than one specialization from one Group. A minimum of TWENTY students is required to offer any specialization area from any two groups. The specialisation area opted for in the 5th Semester would remain the same in all further semesters.

GROUP A	GROUP-B	GROUP-C
Human Resource Management	Marketing	Finance
Business Analytics	Supply Chain Management	International Business

Scheme of Studies and Examination
BBA – 6th Semester

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical / Viva-Voce	Total
1	Core Course	CC-BBA-302B	Project Management	3	1	0	4	4	30	70	-	100
2	Core Course	CC-BBA-304B	Business Taxation	2	0	0	2	2	30	70	-	100
3	Discipline Specific Elective	Table-I Discipline Specific Elective	Specialization-I (Course-2)	3	1	0	4	4	30	70	-	100
4	Discipline Specific Elective	Table-I Discipline Specific Elective	Specialization-II (Course-2)	3	1	0	4	4	30	70	-	100
5	Discipline Specific Elective	Table-I Discipline Specific Elective	Additional DSE (3-1-0) (Audit Course) *	-	-	-	-	No Credit	-	-	-	-
6	Skill Enhancement Course	SEC-306B	Corporate Governance	2	0	0	2	2	30	70	-	100
7	Project Report	RP-BBA-302B	Major Project Report	-	-	-	4	4	-	-	100	100
Total Credits								**20**				**600**

Note:

1. *An Audit Course is a non-credit course that is undertaken for learning purposes only. If successfully completed, the audit course may be recorded. Additional DSE is an Audit Course (Non-Credit but compulsory) to be opted by the student from the list of specializations offered other than the two specialisations chosen by her/ him.
2. Students exiting the Program shall be awarded a 3-year Bachelor of Business Administration upon securing120 credits.
3. At the end of the Sixth Semester, Students opting for 4th year of BBA (Honours) shall undergo Summer Internship-II for 08 Weeks (online/offline/hybrid) in the industry/ Research or Academic Institute. This component will be evaluated during the Seventh semester. The candidates will submit the SIR in the manner specified in the Ordinance.
4. In case of the Project reports/ Dissertation/ Research Project, the assessment shall be jointly carried out by theinternal and external examiners. There shall be no Internal assessment component for Dissertation/ ProjectReport. External examiners shall be invited from amongstthe panel of examiners recommended by the department BOS.

Total Credits (20+20+20+20+20+20) for 3-Year UG Degree in Business Administration	**120**

Exit Criteria after Third Year of BBA Program

The students shall have an option to exit after 3rd year of Business Administration Program and will be awarded with a Bachelor's in Business Administration.

Re-entry Criteria into Fourth Year (Seventh Semester)

The student who takes an exit after third year with an award of BBA may be allowed to re-enter into the seventh semester for completion of the BBA (Honours) or BBA (Honours with Research) Program as per the University schedule after earning requisite credits in the Third year.

Minimum eligibility criteria for opting the course in the fourth year will be as follows:

- **BBA (Honours with Research):** Minimum 75% marks or equivalent CGPA in BBA Degree up toSixth Semester.
- **For BBA (Honours):** BBA Degree

Scheme of Studies and Examination
BBA – 7th Semester (Honours)

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical / Viva-Voce	Total
1	Core Course	CC-BBA-H-401B	Entrepreneurial Leadership	2	2	0	4	4	30	70	-	100
2	Discipline Specific Elective	Table-I Discipline Specific Elective	Specialization-I (Course-3)	3	1	0	4	4	30	70	-	100
3	Discipline Specific Elective	Table-I Discipline Specific Elective	Specialization-II (Course-3)	3	1	0	4	4	30	70	-	100
4	Open Elective	OE-BBA-H-401B	AI for Business	3	1	0	4	4	30	70	-	100
5	Internship	INT-BBA-H-401B	Internship Report-II	-	-	-	-	4	-	-	100	100
Total Credits								**20**				**500**

Note:

1. The duration of all the end-term theory examinations shall be 3 hours.

2. The Criteria for awarding the formative assessment of 30 marks throughout the Program shall be as under:
   a) Sessional Examination: 50% of Assessment marks.
   b) Assignments/ Presentations/ Seminars and Class Participation: 30% of Assessment marks.
   c) Attendance: 20% of Assessment marks.
   (Less than 65% - 0% of Attendance marks; 65%-74.99% - 25% of Attendance marks; 75%-79.99% - 45% of Attendance marks; 80%-84.99% - 60% of Attendance marks; 85%-89.99% - 80% of Attendance marks; 90%-100% - 100% of Attendance marks)

The Criteria for awarding the Formative assessment of the practical course throughout the Program shall be as under:
   a) Practical Assignments/Practical File : 06 Marks (60% Weightage of Assessment)
   b) Attendance (Criteria as mentioned above in 2(c)) : 04 marks (40% Weightage of Assessment)

3. The panel of examiners for end-semester theory examinations shall be prepared and approved by the BOS, comprising internal and external examiners based on their expertise, specialization, and area of interest.

4. The criteria for Internship Evaluation will be as follows:

After completion of internship, students need to prepare a comprehensive report highlighting their learning and takeaways during the internship period. The internship report prepared after completion shall be assessed in the 5th semester as a compulsory course. The candidates will submit the internship report in the prescribed format designed by the department. The report shall be signed by the Internship Supervisor from respective Department and Mentor from internship providing organisations. Evaluation of internship report and viva-voce will be jointly conducted by Internship Supervisor and Mentor on the time and date notified by the concerned HoD. The mentor from host organization may participate in the evaluation through online/ offline mode. In case of nonavailability of respective mentor, the available relevant mentor as decided by the concerned head of the department, may be utilized for the purpose of evaluation.

Suggested distribution of marks will be as below:

Assessment by Mentor- 30 Marks (Skills learned- 15 Marks; Regularity- 10 Marks; Conduct- 5 Marks)

Internship Report - 40 Marks and Viva-Voce - 30 Marks

6. In the Seventh Semester, every student has to submit a synopsis for a dissertation to the department prepared in consultation with his/ her Research Supervisor and appear before a Research Advisory Committee (RAC) constituted by the concerned Department. This component will be evaluated during the eighth semester.

Scheme of Studies and Examination
BBA (Honours) – 8th Semester (Honours)

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			FormativeAssessment	Summative Assessment	Practical / Viva-Voce	Total
1	Discipline Specific Elective	Table I: Discipline-Specific Elective	Specialization-I (Course-4)	3	1	0	4	4	30	70	-	100
2	Discipline Specific Elective	Table I: Discipline-Specific Elective	Specialization-II (Course-4)	3	1	0	4	4	30	70	-	100
3	Discipline Specific Elective	Table I: Discipline-Specific Elective	Specialization-I (Course-5) OR Specialization-II (Course-5)	3	1	0	4	4	30	70	-	100
4	Research Project/Dissertation	RP-BBA-H-402B	Dissertation Work	-	-	-		8			200	200
Total Credits								**20**				**500**

Note:
1. In case of the Project reports/ Dissertation/ Research Project, the assessment shall be jointly carried out by the internal and external examiners. There shall be no Internal assessment component for Dissertation/ Project Report. External examiners shall be invited from amongst the panel of examiners recommended by the department BOS.

Total Credits (20+20+20+20+20+20+20+20) for Four Year BBA Honours	**160**

Scheme of Studies and Examination
BBA – 7th Semester (Honours with Research)

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical / Viva-Voce	Total
1	Core Course	CC-BBAR-401B	Advanced Data Analysis Tools (Theory)	2	0	0	2	2	20	50	-	70
			Advanced Data Analysis Tools (Practical)	0	0	4	4	2	10	-	20	30
2	Core Course	CC-BBAR-403B	Advanced Research Methodology (Theory)	2	0	0	2	2	20	50	-	70
			Advanced Research Methodology (Practical)	0	0	4	4	2	10	-	20	30
3	Discipline Specific Elective	Table-I Discipline Specific Elective	Specialization-I (Course-3)	3	1	0	4	4	30	70	-	100
4	Discipline Specific Elective	Table-I Discipline Specific Elective	Specialization-II (Course-3)	3	1	0	4	4	30	70	-	100
5	Internship Report	INT-BBAR-401B	Internship Report	-	-	-	-	4	-	-	100	100
Total Credits								**20**				**500**

Note:

1. The criteria for Internship Evaluation will be as follows:

After completion of internship, students need to prepare a comprehensive report highlighting their learning and takeaways during the internship period. The internship report prepared after completion shall be assessed in the 5th semester as a compulsory course. The candidates will submit the internship report in the prescribed format designed by the department. The report shall be signed by the Internship Supervisor from respective Department and Mentor from internship providing organisations. Evaluation of internship report and viva-voce will be jointly conducted by Internship Supervisor and Mentor on the time and date notified by the concerned HOD. The mentor from host organization may participate in the evaluation through online/ offline mode. In case of nonavailability of respective mentor, the available relevant mentor as decided by the concerned head of the department, may be utilized for the purpose of evaluation. Suggested distribution of marks will be as below:

Assessment by Mentor- 30 Marks (Skills learned- 15 Marks; Regularity- 10 Marks; Conduct- 5 Marks)

Internship Report - 40 Marks and Viva-Voce - 30 Marks

2. In the Seventh Semester, every student has to submit a synopsis for a dissertation to the department prepared in consultation with his/ her Research Supervisor and appear before a Research Advisory Committee (RAC) constituted by the concerned Department. This component will be evaluated during the eighth semester.

Scheme of Studies and Examination
BBA – 8th Semester (Honours with Research)

Sr. No.	Category	Course Code	Course Title	Hours per Week			Total Load Per Week	Credits	Examination Schedule (Marks)			
				L	T	P			Formative Assessment	Summative Assessment	Practical / Viva-Voce	Total
1	Research Project/ Dissertation	RP-BBA-R-402B	Dissertation	-	-	-	-	20	-	-	500	500
Total Credits								**20**				**500**

Note:
1. The topic of the Dissertation to be submitted for evaluation in the eighth Semester shall be submitted by the student along with a brief synopsis after finalization in the 7th Semester in consultation with his/ her Research Supervisor and appear before a Research Advisory Committee (RAC) constituted by the concerned Department.
2. In case of the Project reports/ Dissertation/ Research Project, the assessment shall be jointly carried out by the internal and external examiners. There shall be no Internal assessment component for Dissertation/ Project Report. External examiners shall be invited from amongst the panel of examiners recommended by the department BOS.
3. Students undertaking the research dissertation may have their research findings patentable, presented at conferences or seminars, or published in peer-reviewed journals.

Total Credits (20+20+20+20+20+20+20+20) for Four Year BBA Honours with Research	**160**

Table I: Discipline-Specific Electives

List of Courses Offered for Various Specializations under Discipline-Specific Electives

Human Resource Management			
Course Code	**Semester**	**Course**	**Title of the Course (s)**
DSE-BBA-HR-301B	5	1	Training & Development
DSE-BBA-HR-302B	6	2	Performance & Compensation Management
DSE-BBA-HR-401B	7	3	Change Management and Organizational Development
DSE-BBA-HR-402B	8	4	HRD– Systems & Strategies
DSE-BBA-HR-404B	8	5	Talent Acquisition and Management
Business Analytics			
Course Code	**Semester**	**Course**	**Title of the Course (s)**
DSE-BBA-BA-301B	5	1	Social media & Web Analytics
DSE-BBA-BA-302B	6	2	Data Analytics using R/Python
DSE-BBA-BA-401B	7	3	Finance Analytics
DSE-BBA-BA-402B	8	4	Marketing Analytics
DSE-BBA-BA-404B	8	5	HR Analytics
Marketing			
Course Code	**Semester**	**Course**	**Title of the Course (s)**
DSE-BBA-MM-301B	5	1	Consumer Behavior
DSE-BBA-MM-302B	6	2	Sales Marketing
DSE-BBA-MM-401B	7	3	Retail Marketing
DSE-BBA-MM-402B	8	4	Integrated Marketing Communication
DSE-BBA-MM-404B	8	5	Digital Marketing
Supply Chain Management			
Course Code	**Semester**	**Course**	**Title of the Course (s)**
DSE-BBA-SCM-301B	5	1	Inventory Management
DSE-BBA-SCM-302B	6	2	Logistics & Distribution Management
DSE-BBA-SCM-401B	7	3	Management Decision Models
DSE-BBA-SCM-402B	8	4	Quality Management and Business Process Improvement
DSE-BBA-SCM-404B	8	5	International Supply Chain

Finance			
Course Code	**Semester**	**Course**	**Title of the Course (s)**
DSE-BBA-FIN-301B	5	1	Financial Planning
DSE-BBA-FIN-302B	6	2	Financial Markets Products and Services
DSE-BBA-FIN-401B	7	3	Financial Derivatives
DSE-BBA-FIN-402B	8	4	Investment Analysis & Portfolio Management
DSE-BBA-FIN-404B	8	5	Direct Tax
International Business			
Course Code	**Semester**	**Course**	**Title of the Course (s)**
DSE-BBA-IB-301B	5	1	Global Business Environment
DSE-BBA-IB-302B	6	2	Transnational & Cross-Cultural Marketing
DSE-BBA-IB-401B	7	3	EXIM Policy and Documentation
DSE-BBA-IB-402B	8	4	International Ventures, Mergers & Acquisitions
DSE-BBA-IB-404B	8	5	International Trade Policy & Strategy

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

Approved by AICTE, New Delhi and Affiliated to MDU, Rohtak

NAAC 'A' GRADE

SYLLABI

OF

1st and 2nd Year

BACHELOR OF BUSINESS ADMINISTRATION PROGRAM

(BBA)

WITH EFFECT FROM THE

SESSION 2026-27

Course Code	**CC-BBA-101B**				
Category	Core Courses				
Course Title	**Principles and Practices of Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand the basic concepts, principles, and theories of management. 2. To examine the essential functions of managers. 3. To analyze the impact of globalization, diversity, and ethics on management. 4. To develop skills in strategic planning, decision-making, and leadership.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Recall** the basic concepts, principles, and fundamental ideas related to management and organizational practices.	Level-1 Remember
CO2	**Explain** the key managerial functions, processes, and approaches used in managing organizations effectively in different situations.	Level-2 Understand
CO3	**Apply** managerial concepts, techniques, and decision-making tools to solve practical problems in organizational settings.	Level-3 Apply
CO4	**Analyze** management principles, organizational structures, leadership practices, control systems, and strategic approaches to improve managerial effectiveness and decision-making.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each)from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	**Contents**
Unit-I	**Introduction to Management: Definition**, nature, and significance of management, principles of management, management and administration, levels of management, role of managers and managerial skills; Evolution of management thought: Classical, Behavioral, Quantitative, Systems, Contingency and Modern approaches; Management as a science and an art; Functions of management: Planning, organizing, leading, and controlling.
Unit-II	**Planning, Organizing and Staffing: -**Nature, Importance and Purpose of planning in management; Types of plans: Strategic, tactical, operational; Planning process and techniques; Decision-Making Importance and steps, decision-making models and tools; Organizational structure and design; types of organizational structures: Functional, divisional, matrix; Authority, responsibility and delegation, Centralization Vs Decentralization of authority and responsibility –

	Span of Control; Coordination and integration, MBO and MBE; Nature and Importance of staffing – Process of selection and recruitment.
Unit-III	**Leading, Directing and Controlling:-** Meaning and nature of directing, Leadership theories (trait, behavioral, contingency, participative, charismatic, transformational, level-5 leader), Motivation theories and practices (Maslow, Herzberg two factor, McGregor's theory x & theory y), Hawthorne effect, Communication (meaning and importance) in management, Team building and group dynamics; Controlling-meaning and steps in controlling, control process and systems, essentials of sound control system, methods of establishing control, types of control; Performance measurement and management.
Unit-IV	**Strategic Management, Ethics and Social Responsibility: -** Overview of strategic management, SWOT analysis and strategic formulation, implementing and evaluating strategies. Ethical issues in management, Corporate social responsibility (CSR), and Sustainable management practices.

Suggested Readings:

- Management Principles and Applications, Rao, V. S. P., Taxmann Publications.
- Principles of Management Bright, D. et al. Open Stax Textbooks, Houston.
- Principles of Management, Kapoor, Premvir, Khanna Book Publishing
- Essentials of contemporary management, Jones, G. R., and George, J. M. New York, NY: McGraw-Hill Education.
- Management, Robbins, S. P. & Coulter, M. A., Pearson.
- Management concept and practice by C.B. Gupta, S Chand Publication, New Delhi.
- Principles and Practices of Management by R.S.Gupta, Kalyani Publications, New Delhi.
- Principles and Practice of Management by LM Prasad, Sultan Chand and sons, New Delhi.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Principles of Management	https://nptel.ac.in/courses/110107150
Unit-II	Management By Objectives	https://nptel.ac.in/courses/110107150
Unit-III	Motivation Theories	https://youtu.be/nWxNFkqGlsM
Unit-IV	Introduction to CSR	https://youtu.be/cgYnos1Gf6g?si=nsCzxHLzfOH6kTa_

Course Code	**CC-BBA-103B**				
Category	Core Courses				
Course Title	**Financial Accounting**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To provide an understanding of the application of various principles and practices of accounting. 2. To demonstrate the knowledge of the process of the accounting cycle and basic steps involved in accounting. 3. To apply the knowledge of systematic maintenance of books of accounts to real life business. 4. To estimate Annual Financial statements of Sole proprietorship and Company form of business.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the fundamental concepts, principles, standards, and processes of accounting and financial reporting.	Level-1 Remember
CO2	**Explain** accounting procedures related to recording transactions, trial balance, final accounts, company accounts, and sustainable financial reporting.	Level-2 Understand
CO3	**Apply** accounting principles and procedures for journalizing, ledger posting, preparation of trial balance, final accounts, and financial statements in different business organizations.	Level-3 Apply
CO4	**Analyze** accounting information, financial statements, disclosure practices, and sustainability reporting for effective financial decision-making and business evaluation.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each)from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to Accounting, Accounting System and Process: -**Meaning, Need for accounting and accounting information system, Stakeholder using accounting information, Qualitative aspects of financial accounting, Accounting standards in India and International (outline), Branches of Accounting, Types of Business Organisations, Accounting taxonomy, Accounting concepts and conventions, Accounting concept of income and expenditure, Classification of capital and revenue expenditure and income, accounting equation of assets equals capital and liabilities, accounting process, contingent assets and liabilities, Fictitious assets.

Unit-II	**Recording transactions and Trial balance: -** Transactions -nature, Entry in Journal, Purchases, sales, Returns, Receivables, and payables, Inventory, Depreciation and amortizations, reserves, Intangible assets accounting, GST transactions, Entry in Ledger, Accounting accuracy through Trial balance, correction of errors.
Unit-III	**Final Accounts: -** Preparation of Trading and Profit and Loss account, cash books, and Balance Sheet of sole trading concerns, importance of disclosures in final accounts. Computerized Accounting Using Software. AI-based tools and technologies in accounting practices.
Unit-IV	**Company Final Accounts: -**Introduction to company – kinds, share capital, issue of shares, schedules to accounts, financial statements as per Companies Act- 2013, Provisions as to Preparation of Financial Statements, Preparation of Income statement and Balance sheet (horizontal and Vertical). Green Accounting and Sustainable Reporting: need and objectives; sustainability reporting needs and methods; data collection and analysis for sustainable reporting to improve business value; IFRS Financial Sustainability Disclosure Standards.

Suggested Readings:

- Basic Financial Accounting I, Jain S.P., & Narang K L, New Delhi, Kalyani publishers.
- Financial accounting, Kimmel, Wiley Publications
- Financial Accounting for Management: An Analytical Perspective, Gupta, A., Noida, Pearson Education.
- Financial Accounting, S.N. Maheshwari, and S.K.Maheshwari,Vikas Publishing House, New Delhi.
- Essentials of Financial Accounting for Business Managers, Ashish k Battacharya, Six, PHL learning.
- Accounting for sustainability, www.ifac.org
- Green Accounting, Peter Bartelmus, E K Seifert, London, Routledge Publications
- IFRS sustainability standards: www.ifrs.org
- Financial Accounting by MK Gupta, CL Chaturvedi, Shree Mahavir Book Publishers, New Delhi
- Financial Accounting by P.C. Tulsain, Pearson Education, New Delhi
- Fundamentals of Financial Accounting by DK Goel, Rajesh Goel, Shelly Goel, Arya Publisher, New Delhi

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Financial Accounting	https://nptel.ac.in/courses/110106147
Unit-II	Trial Balance	https://youtu.be/iOQvbp1ejbA?si=XeRmhyGrygjgXpA-
Unit-III	Preparation of final accounts	https://nptel.ac.in/courses/110106147
Unit-IV	Final Accounts of a Company and Statutory Provisions	http://sdnbvc.digimat.in/nptel/courses/video/110106147/L54.html

Course Code	**CC-BBA-105B**				
Category	Core Courses				
Course Title	**Business Statistics and Logic**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand data classification, presentation, and statistical measures of central tendency, dispersion, skewness, and kurtosis for effective data analysis. 2. To learn about relationships between variables using correlation and regression techniques for interpretation and prediction. 3. To introduce fundamental concepts of probability and probability distributions and apply them to solve real-life and business-related problems. 4. To enhance logical, analytical, and reasoning skills through numerical, analytical, and deductive reasoning techniques.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** fundamental concepts and terminology used in business statistics and logical analysis.	Level-1Remember
CO2	**Explain** the applications of statistical methods to interpret and summarize data accurately.	Level-2Understand
CO3	**Apply** statistical tools and techniques to solve problems.	Level-3Apply
CO4	**Analyze** data and statistical methods in real-world applications.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 mark (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total; first question is compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Measures of Central Tendency, Dispersion, Measures of Skewness and Kurtosis:-** Classification and tabulation of data, frequency distribution, diagrams and graphs, measure of central tendency- arithmetic mean, weighted arithmetic mean, median, mode, geometric mean and harmonic mean (theory only) and meaning of partition values- quartiles, deciles, percentiles, measures of dispersion - range, quartile deviation, mean deviation from mean and median, standard deviation and coefficient of variation. Skewness - meaning, difference between dispersion and skewness, Karl Pearson's and Bowley's measures of skewness, concept of kurtosis, types of kurtoses and importance.
Unit-II	**Correlation and Regression: -** Meaning, definition and use of correlation, covariance, scatter diagram, types of correlation, Karl Pearson's correlation coefficient, Spearman's Rank correlation coefficient, probable error. regression- meaning and utility of regression analysis, comparison between correlation and regression, regression lines –x on y, y on x, regression equations and regression coefficients.

Unit-III	**Probability and Probability distributions: -** Introduction to probability, basic concepts of probability- classical definition, addition and multiplication rules, probability distributions – binomial, poisson and normal distributions, expected value.
Unit-IV	**Introduction to Logic: -** Number series, coding, decoding and odd one out series, direction sense test, seating arrangements – linear and circular, blood relations, arithmetic and geometric progressions, Inductive and deductive reasoning.

Suggested Readings:

- Statistics for Management, Levin R. I. & Rubin D. S., Delhi: Pearson.
- Theory and Practice, Pillai & Bagavathi. Statistics, S Chand Publishing
- Statistical Methods, SP Gupta, Sultan Chand and Sons
- Fundamentals of Statistics, SC Gupta, Fundamentals of Statistics, Himalaya Publishing House
- The Practice of Business Statistics, Sharma, Gupta, Khanna Publishing House.
- Business Statistics, Sharma J.K., Vikas Publishing House
- Business Statistics by TR Jain, SC Aggarwal,VK Global,New Delhi
- Business Statistics by GC Beri, MGH Publishers, Chennai

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Statistics and Data	https://nptel.ac.in/courses/110107114?utm
Unit-II	Regression	https://nptel.ac.in/courses/110107114?utm
Unit-III	Introduction to Probability Theory and Statistics	https://onlinecourses.nptel.ac.in/noc25_ma33/preview?utm
Unit-IV	Deductive and Inductive Reasoning	https://www.nptelprep.in/courses/109104040/materials?utm

Course Code	**AEC-BBA-105B**				
Category	Ability Enhancement Course				
Course Title	**General English**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	1	1	0	**2**	
Course Objectives	The objectives of this course are 1. To provide learning environment to practice listening, speaking, reading and writing skills. 2. To assist the students to carry on the tasks and activities through guided instructions and materials. 3. To effectively integrate English language learning with employability skills and training. 4. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Define** fundamental concepts of vocabulary, grammar, and language structures used in effective communication.	Level-1 Remember
CO2	**Explain** principles of writing and speaking skills, including sentence construction, paragraph development, and oral communication techniques.	Level-2 Understand
CO3	**Apply** writing and oral communication skills to construct correct sentences, develop coherent paragraphs, and communicate effectively in written form.	Level-3 Apply
CO4	**Apply** oral and written communication techniques to improve clarity, accuracy, and effectiveness in academic and professional situations.	Level-3 Apply

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each)from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	**Contents**
Unit-I	**Vocabulary Building: -**The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.
Unit-II	**Basic Writing Skills: -** Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.
Unit-III	**Identifying Common Errors in Writing: -** Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies. **Nature and Style of Sensible Writing**: - Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Writing Practices, Comprehension, Precise Writing and Essay Writing.
Unit-IV	**Oral Communication: -** Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm,

	Common Everyday Situations: Conversations and Dialogues, Communication at the Workplace, Interviews, and Formal Presentations.

Suggested Readings:

- Effective Communication Skills, Kul Bhushan Kumar, Khanna Book Publishing,
- Practical English Usage, Michael Swan. OUP.
- Remedial English Grammar, F.T. Wood. Macmillan.
- On Writing Well, William Zinsser. Harper Resource Book.
- Study Writing, Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.
- Communication Skills, Sanjay Kumar and PushpLata, Oxford University Press.
- Exercises in Spoken English, Parts. I-III, CIEFL, Hyderabad, Oxford University Press.
- English Phonetics for Indian Students by T Balasubramanian, Triunity Press, Bengaluru
- English Grammar in Use by Murphy, Raymond, Cambridge University Press, Cambridge

Useful Video Links:

Unit No	Topics	Links
Unit-I	Synonyms	https://youtu.be/mgLlPJkxmFU?si=UJpRjVm3tZi8iYm6
Unit-II	Techniques for writing precisely	https://nptel.ac.in/courses/109107172
Unit-III	Subject-verb agreement	https://nptel.ac.in/courses/109106116
Unit-IV	Communication at Workplace	http://digimat.in/nptel/courses/video/109107394/L12.html

Course code	**AEC-BBA-109B**				
Category	Ability Enhancement Course				
Course title	**Business Communication-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	1	1	0	**2**	
Course Objectives	The objectives of this course are 1. To understand the concept, process, and importance of Business Communication. 2. To help students in understanding the basic principles and techniques of business communication. 3. To train students to acquire and master written communication for the corporate world. 4. To sensitize students to understand Business Communication in Global and Cross-Cultural context.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Recall** the fundamental concepts and principles related to effective communication in organizational contexts.	Level-1 Remember
CO2	**Explain** the processes, methods, and practices used for clear and effective communication in different professional situations.	Level-2 Understand
CO3	**Apply** appropriate communication techniques for effective written, oral, digital and professional interactions in real-life situations.	Level-3 Apply
CO4	**Apply** communication skills to improve effectiveness in professional, interpersonal, and digital environments.	Level-3 Apply

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each)from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	**Contents**
Unit-I	**Introduction to Communication in Organizations: -** Introduction to Business Environment and Communication, Models of communication, Basics of Communication (types, channels and barriers), 7Cs of communication, Formal and informal communication, Listening Skills, communication on social media platforms.
Unit-II	**Written Communication: -** Planning and executing different types of messages, emails, formal letters (Planning & Layout of Business Letter) and informal messages on e-platforms, negative messages: indirect & direct negative messages; Persuasive messages, request letters to various stakeholders, Sales Letters, Complaint & Follow up Letters, Promotion Letters, Job application Letters, cover letters, resume, Resignation Letters.
Unit-III	**Interpersonal Communication: -** Team communication, managing communication during online

	Meeting, communication with virtual team, communication in gig economy; Presentation skills (Verbal and non-verbal); PowerPoint presentation skills; Info graphics, introduction to contemporary alternatives (such as- Prezi, Visme, Microsoft Sway, Zoho).
Unit-IV	**Digital Communication: -** Social media and individual, social media & organizations, Media Literacy; Strong Digital communication skills – email, instant messaging, video conferencing, e-meetings, Digital collaboration, digital citizenship –digital etiquette& responsibilities; introduction to personal and organizational websites.

Suggested Readings:

- AICTE's Prescribed – Communication Skills in English, Khanna Book Publishing.
- Business Communication: Connecting in a Digital World, Lesikar, R.V. & M.E. Flatley, McGraw-Hill Education.
- Effective Business Communication, Murphy, H. A., Hildebrandt, H. & Thomas, J.P., McGraw Hill.
- Business Communication: Connecting at Work, Mukerjee H. S., Oxford Publication.
- Business Communication Today, Boove, C.L., Thill, J. V. & Raina, R. L, Pearson.
- Business Communication by Meenakshi Raman, Prakash Singh, Oxford Higher Education, New Delhi
- Business Communication by Urmila Rai , Himalaya Publishing House, New Delhi
- Business Correspondence and Report Writing by RC Sharma , Krishna Mohan, TMH, New Delhi

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to communication in organizations	http://digimat.in/nptel/courses/video/110105052/L01.html
Unit-II	Written Communication	https://www.digimat.in/nptel/courses/video/109104031/L09.html
Unit-III	Oral Presentation	https://youtu.be/z-ce7fcKe1E
Unit-IV	Digital Communication	https://nptel.ac.in/courses/117101051

Course Code	**AEC-BBA-107B**				
Category	Additional Course				
Course Title	**French**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	1	1	0	**2**	
Course Objectives	The objectives of this course are 1. To understand foundational language skills necessary for basic communication, including introducing themselves and others, describing places, and talking about their surroundings. 2. To focus on enhancing students' ability to express personal likes, interests, and other simple ideas, ensuring their ability to engage in basic communicative transactions. 3. To achieve a partial A1 level by the end of the semester according to the Common European Framework, which will enable them to handle simple communication in everyday situations.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** key concepts related to reading, listening, speaking, and writing in English, focusing on everyday communication.	Level-1 Remember
CO2	**Explain** basic communication techniques for understanding texts, listening to simple conversations and expressing oneself in writing.	Level-2 Understand
CO3	**Apply** reading skills to use simple texts (e.g., notices, short passages, emails) and extract relevant information to answer questions or complete given tasks.	Level-3 Apply
CO4	**Apply** listening skills to understand simple conversations or audio messages and respond appropriately by completing activities such as answering questions or writing brief personal messages.	Level-3 Apply

Unit No.	Contents
Unit-I	**Reading:** Reading Simple Texts Related to One's Immediate Environment such as Notices, Posters, Catalogs, Fliers, Personal Messages or Emails and Answering Questions on them.
Unit-II	**Listening:** Understanding familiar Words and very Basic Phrases about Oneself, One's Family, and Immediate Concrete Surroundings, such as Very Brief Announcements in Public Spaces, Short, Simple Formal/Informal Conversation, Questions and Instructions When Speakers are Speaking at a Slower Pace.
Unit-III	**Writing:** Guided Writing will Include activities such as, Filling a Form, Writing Simple Phrases (Postcards, Messages, Invitations etc) on everyday Topics.
Unit-IV	**Monologue**: Describing and Presenting oneself, One's Immediate Environment and the People S/He Knows Using Simple Phrases and Sentences. **Dialogue:** Taking part in a Conversation and Interaction in a Simple way provided the other Person

	is Prepared to Repeat or to Rephrase more Slowly and help Formulate what S/he is trying to say asking simple Questions on familiar Topics or Matters related to one's Immediate Environment. Making simple Purchases in Shops or Obtaining Services that one Requires.

Suggested Readings:

- Mon Posseport by Preeti Bhutani, Unisec Publication, Delhi
- Kizirian, V. M, Daill, E., Berthet, A., Hugot, C., Waendendries, M. Alter Ego + 1. Paris: Hachette.
- Berthet, A., Daill, E., Hugot, C., Waendendries, M. Alter Ego+ 1, Cahier d'activités. Paris: Hachette.
- Hachette, Y., Mérieux, R. Latitudes 1, (Livre de l'élève& Cahier d'exercices). Paris: Didier.
- Cocton, M-N., Dupleix, D., Heu, E., Kasazian, E., Ripaud, D.Saison 1, (Livre de l'élève& Cahier d'exercices). Paris: Didier.
- Denyer, M., Garmendia, A., Lions-Olivieri, M-L. Version Originale 1, Livre de l'élève. Paris: Editions Maisons des Langues.
- Magne, M., Lions-Olivieri, M-L. Version Originale 1, Cahier d'exercices. Paris: Editions Maisons des Langues.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	French Absolute Beginners Guide	https://www.youtube.com/watch?v=Sk6YQynZ1h8
Unit-II	French Listening Practice -50 Everyday French Sentences	https://www.youtube.com/watch?v=Aofb0XEJIks
Unit-III	Learn how to write French with me	https://www.youtube.com/watch?v=9iUiei9YMCk
Unit-IV	Slow and Easy French Conversation Practice	https://www.youtube.com/watch?v=ReVCwcHwnZI

Course Code	**VAC-BBA-101B**				
Category	Value Added Courses				
Course Title	**Environmental Science and Sustainability**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To familiarize students with basic environmental concepts, their relevance to business operations and forthcoming sustainability challenges. 2. To equip students to make decisions that consider environmental consequences. 3. To enable future business graduates to become environmentally sensitive and responsible managers.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Define** the fundamental concepts of environment, sustainability, natural resources, ecosystems, biodiversity, pollution, and environmental legislation.	Level-1 Remember
CO2	**Describe** environmental challenges, ecosystem dynamics, biodiversity conservation, pollution control measures, waste management practices, and sustainable development initiatives.	Level-2 Understand
CO3	**Apply** sustainable practices, resource conservation methods, pollution control measures, disaster management approaches, and environmental ethics in business and societal contexts.	Level-3 Apply
CO4	**Apply** environmental laws, sustainability principles, and responsible business practices to address environmental and social issues for sustainable development.	Level-3 Apply

Unit No.	**Contents**
Unit-I	**Understanding Environment, Natural Resources, and Sustainability:** Fundamental environmental concepts and their relevance to business operations; Components and segments of the environment, the man-environment relationship, and historical environmental movements. Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation. Sustainable practices in managing resources, including deforestation, water conservation, energy security, and food security issues. The conservation and equitable use of resources, considering both intergenerational and intergenerational equity, and the importance of public awareness and education.
Unit-II	**Ecosystems, Biodiversity, and Sustainable Practices: -** Various natural ecosystems, learning about their structure, functions, and ecological characteristics. The importance of biodiversity, the threats it faces, and the methods used for its conservation. Ecosystem resilience, homeostasis, and carrying capacity, emphasizing the need for sustainable ecosystem management. Strategies for in situ and ex situ conservation, nature reserves, and the significance of India as a mega diverse nation.
Unit-III	**Environmental Pollution, Waste Management, and Sustainable Development: -** Various types of environmental pollution, including air, water, noise, soil, and marine pollution, and their impacts on businesses and communities.

	Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management; Natural and man-made disasters, their management, and the role of businesses in mitigating disaster impacts.
Unit-IV	**Social Issues, Legislation, and Practical Applications: -**Dynamic interactions between society and the environment, with a focus on sustainable development and environmental ethics. Role of businesses in achieving sustainable development goals and promoting responsible consumption. Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Environmental justice, environmental refugees, and the resettlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India.

Suggested Readings:

- Environmental Studies, Poonia, M.P., Khanna Book Publishing Co.
- Textbook of Environmental Studies, Bharucha, E., Orient Blackswan Private Ltd.
- Text Book of Environmental Studies, Dave, D., & Katewa, S. S., Cengage Learning India Pvt Ltd.
- Environmental studies: from crisis to cure, Rajagopalan, R., Oxford University Press.
- Living in the Environment, Miller, G.T. & Spoolman S., Cengage Learning India Pvt Ltd.
- Fundamentals of environmental studies, Basu, M., & Xavier Savarimuthu, S. J., Cambridge University Press.
- Sustainable Development: Environment, Energy and Water Resources, Roy, M. G., Ane Books.
- Environmental Studies by BB Chawdhary, CL Chaturvedi, Mahavir Publication Company, New Delhi

Useful Video Links:

Unit No	Topics	Links
Unit-I	Natural Resource Management	https://nptel.ac.in/courses/126103022
Unit-II	Ecosystem and it's Components	https://nptel.ac.in/courses/105105826
Unit-III	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Principles of Sustainable Development	https://nptel.ac.in/courses/109105203

Course Code	**MDE-BBA-101B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Knowledge Systems and Traditions**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To understand the fundamental concepts of Indian Knowledge Systems, Indian culture, civilization, and ancient scientific traditions. 2. To understand the significance of traditional Indian creative practices, arts, architecture, music, dance, and craftsmanship. 3. To understand the relevance and application of Indian Knowledge Systems and creative practices in modern society and sustainable development.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**List** the concepts of Indian Knowledge System, Indian culture and civilization, ancient Indian sciences, architecture, and philosophical systems	Level-1 Remember
CO2	**Explain** the principles and significance of Indian creative practices, traditional arts, crafts, music, dance, painting, and engineering techniques.	Level-2 Understand
CO3	**Apply** traditional Indian knowledge and creative practices in activities related to art, design, performance, craftsmanship, and cultural expression.	Level-3 Apply
CO4	**Analyze** the relevance and contributions of Indian Knowledge Systems and creative practices to modern society, culture, science, and sustainable living.	Level-4 Analyze

Notes:

1. Any eight of the total sessions assigned for the Literary activity from Unit I and Unit II.
2. Twenty Lectures with at least five different topics of total sessions under Creative activity from Unit-III and Unit-IV.

Unit No.	Contents
Unit-I	**Introduction to IKS:** Indian Knowledge System, Indian Culture & Civilization, Ancient Indian Chemistry, Ancient Indian Metallurgy, Ancient Indian Mathematics, Ancient Indian Astronomy, Indian Astronomical Instruments.
Unit-II	**Indian Knowledge System:** (Upveda: Ayurveda, Gandharveda), (Vedangas: Shiksha, Kalpa, Vyakrana, Jyotisha, Nirukta, Chandas). Indian Architecture: I-Sthapatya-Veda, II: Temples, III: Town & Planning. Indian Philosophical System
Unit-III	**Introduction to Creative Practices:** Dhatuvada: art of metallurgy**,** Akara jnana: art of mineralogy**,** Vastuvidya: art of engineering**,** Yantramatrika: art of mechanics**,** Takshana: art of carpentry**,** Chalitakayoga: art of practising as a builder of shrines**,** Raupyaratnapariksha: art of testing silver and jewels**,**Maniraga jnana: art of tinging jewels**,** Sucivayakarma: art of needle works and weaving**,** Vadya vidya: art of playing on musical instruments**,** Geet vidya: art of singing**,** Nritya vidya: art of dancing.
Unit-IV	**Creative Practices:** Natya vidya: art of theatricals**,** Alekhya vidya: art of painting**,** Viseshakacchedya vidya: art of painting the face and body with color**,** Udakavadya: art of playing on music in water**,** Manasi kavyakriya: art of composing verse**,** Bhushanayojana: art of applying or setting ornaments**,** Citrasakapupabhakshyavikarakriya: art of preparing varieties of delicious food**,** Dasanavasanangaraga: art of applying preparations for cleansing the teeth, cloths and painting the body**,** Utsadana: art of healing or cleaning

	a person with perfumes**,** Vastragopana: art of concealment of cloths**,** Balakakridanaka: art of using children's toys**,** Tandulakusumabalivikara: art of preparing offerings from rice and flowers**,** Pushpastarana: art of making a covering of flowers for a bed.

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru
- Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
- The Cultural Heritage of India. Vol.I. Kolkata:Ramakrishna Mission Publication, 1972.
- Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
- Dr. R. C. Majumdar, H. C. Raychaudhuri and Kalikinkar Datta: An Advanced History of India (Second Edition) published by Macmillan & Co., Limited, London, 1953.
- Rao, N. 1970. The Four Values in Indian Philosophy and Culture. Mysore: University of Mysore.
- Avari, B. 2016. India: The Ancient Past: A History of the Indian Subcontinent from c. 7000 BCE to CE 1200. London: Routledge.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Indian Knowledge Systems	https://www.youtube.com/playlist?list=PLRfu94TCePTtVPR-kC4RpIGIwo7-ViCGP
Unit-II	Indian philosophy, Vedas, Vedangas, traditions, and IKS basics	https://www.youtube.com/watch?v=3H16y-XfMMc
Unit-III	Introduction to Creative Practices	https://www.anaadi.org/iksprimer?utm_source

Course Code	**MDE-BBA-103B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Mathematics and Astronomy**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To understand the foundations of ancient Indian mathematics, astronomy, and numeral systems. 2. To understand the principles of Vedic mathematical methods, astronomical calculations, and ancient scientific texts. 3. To understand the significance of ancient Indian astronomical instruments, time systems, and scientific contributions.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	List the contributions of ancient Indian mathematicians, astronomers, numeral systems, and foundational concepts of Indian mathematics and astronomy.	Level-1 Remember
CO2	Explain the principles of Vedic mathematics, Sulvasutras, algebraic methods, trigonometry, calendrical studies, and astronomical systems described in ancient Indian texts.	Level-2 Understand
CO3	Apply ancient Indian mathematical and astronomical methods related to calculations, planetary motions, time systems, eclipses, and observational techniques.	Level-3 Apply
CO4	Apply ancient Indian mathematical and astronomical methods related to calculations, planetary motions, time systems, eclipses, and observational techniques.	Level-3 Apply

Unit No.	**Contents**
Unit-I	**The Introduction to Ancient Mathematics & Astronomy:** Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, bharat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara). Periodical enlisting of Mathematical & Astrological achievement in India. Evolution of Indian Numerals (Brahmi (1st century), Gupta (4th century) & Devanagri Script (11th century).
Unit-II	**Ancient Mathematics –I:** Veda & Sulvasutras (Pythagoras theorem, Square root & Squaring Circle) (baudhayana sulbhasutra, apastamba sulbhasutra, katyayana sulbhasutra, manava sulbhasutra, maitrayana sulbhasutra, varaha sulbhasutra, vadhula sulbhasutra , Pingala's chandasutras, sunya, yaat-tavat, Aryabhata (Aryabhatiya, Asanna, ardha-jya, kuttaka,), bhaskara (trigonometory,shridhara, mahavira), Bhaskara Acharya (Sidhantashiromani), Varamahira panchasiddhantika.
Unit-III	**Ancient Mathematics –II:** Brahamgupta (vargaprakrati, bhramasphuta siddhanta, bhavana), ayatavrtta, ganitasarasamgraha, lilavathi, ganesadaivajna, randavantika, suryasidhhanta, grahalaghava, sadratnamala, mandavrtta, sighrartta, Bijaganita, Bakshali manuscript Golavada, Madhyamanayanaprakara, Mahajyanayanaprakara (Method of Computing Great Sines), Lagnaprakarana, Venvaroha, Sphutacandrapti, Aganita-grahacara , Chandravakyani (Table of Moon-mnemonics).

Unit-IV	**Ancient Astronomy –I:** Parahita system of astronomy and drk system of astronomy, Manda samskara, sighra samskara. Vedanga Jyotisha (astronomical calculations, calendrical studies, and establishes rules for empirical observation), Aryabhatiya (earth rotation, shining of moon), Brahmasphutasiddhanta (motion of planets), varahmihira (pancasiddhantika), Mahabhaskariya, lahubhaskariya & arybhatiya bhashya (Planetary longitudes, heliacal rising and setting of the planets, conjunctions among the planets and stars, solar and lunar eclipses, and the phases of the Moon), Sisyadhiveddhida (grahadhyaya, goladhyaya), siddhantasiromani, karanakutuhala (planetary positions, conjunctions, eclipses, cosmography), siddhantasekhara, yantra-kirnavali, Sphuṭanirṇaya, Uparagakriyakrama. **Ancient Astronomy –II:** Positional astronomy (sun, planets, moon, coordinate systems, precision of the equinox and its effects, eclipses, comets and meteors), Mahayuga & Kalpa system Yuga system, ayanas, months, tithis and seasons, time units, sun and moon's motion, planet position, ayanachalana, zero-precision year, katapayaadi system, Indian nakshatra system, astronomy Instruments for naked eye astronomy (vedic observatories). The principal and application of Samrat Yantra, Jai Prakash Yantra, Disha Yantra, Rama Yantra, Chakra Yantra, Rashiwalya Yantra, Dingash Yantra, Utaansh Yantra.

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
- R P Kulkarni, Glimpese of Indian Engineering and Technology (Ancient & Medieval period, Munshiram Manoharlal Publishers Pvt. Ltd. 2018
- AK Pathak, Science and Technology in India, Anshika Prakashan pratapgarh, 2016
- NVP, Unithiri, Indian Scientific Traditions (Professor K.N. Neelakantan Elayath FelicitationVolume), publication division univeristy of Calicut, 2006
- Dharmpal, Indian science and technology in the eighteen century, rashtrottahana sahitya, 1983
- S Biswal, B L ray, vedic Science and technology, DK Print world, 2009
- A Kolachana, Studies in Indian Mathematics and Astronomy, Hindustan Book agency
- S B Rao, Indian Mathematics and Astronomy: Some Landmarks (Revised Third Edition), BhartiyaVidhya Bhavan, 2012,
- GG Josheph, Indian Mathematics: Engaging with the World from Ancient to Modern Times, speaking Tiger, 2016
- BS Yadav, Ancient Indian Leaps into Mathematics, brikausher publication, 2010
- DP Chatopadhya, Ravinder kumar, Mathematics, Astronomy, and Biology in Indian Tradition:Some Conceptual Preliminaries (Phispc Monograph Series on History of Philosophy, Science andCulture in India, No 3), Munshiram manohalal publication, 1995.
- BV subbarayappa, The Tradition of Astronomy in India: History of Science, Philosophy and Culturein Indian Civilization Vol. IV, Part 4: Jyotihsastra (History of Science, Philosophy & Culture inIndian Civilization), centre for studies in civilization, 2008.
- GE Clark, The Aryabhatiya of Aryabhata: An Ancient Indian Work on Mathematics and Astronomy,Kesinger publicaition, 2010.
- Anonyms, Hindu Astronomy: Anuradha, Bharani, Hindu Chronology, Hindu Calendar, IndianAstronomy, Kerala School of Astronomy and Mathematics, Jyoti, Book LLC, 2011
- KV Sharma. Ganita yuktibhasa (Analytical Exposition of the Rationales of Indian Mathematics andAstronomy, Kindle, 2021.
- R Mercier, Studies on the Transmission of Medieval Mathematical Astronomy (Variorum CollectedStudies), routledge publication, 2004.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Astronomy in Ancient, Medieval and Early Telescopic Era of India	https://www.youtube.com/watch?v=GZn8DtXVzkk
Unit-II	Aryabhata: A True Gem of Indian Mathematics and Astronomy	https://www.youtube.com/watch?v=LI6mzQvNRRs
Unit-III	Brahmasphuta siddhanta of Brahmagupta	https://www.youtube.com/watch?v=3bNFEJNY4Ds
Unit-IV	Pre Siddhantic Astronomy	https://www.youtube.com/watch?v=BURiuOGylS4

Course Code	**MDE-BBA-105B**				
Category	Multidisciplinary Course				
Course Title	**Indian Vision for Human Society**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To help the learner to understand the concept of "Vasudhaiva kutumbkam" and its realization process as a base for the development of vision for a humane society. 2. To help to identify the universality in humans and its coexistence in existence. 3. To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society. 4. To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing of one and all, at the level of individual, society, nation and ultimately the whole world.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Remember** core concepts related to human existence, consciousness, and social harmony.	Level-1 Remember
CO2	**Understand** the aims of human life and the ethical foundations of individual and societal well-being.	Level-2 Understand
CO3	**Apply** philosophical and ethical principles to personal conduct and social interactions.	Level-3 Apply
CO4	**Apply** integrated knowledge to promote harmony, balance, and purposeful living in society.	Level-3 Apply

Unit No.	Contents
Unit-I	**The world view & Vision of Human Society:-** The concept of non-duality of Prakriti (Jad) and Purush (Chetana), human as coexistence of Jad & Chetan, Pancha-mahabhutas, the root of sorrow and suffering, freedom from sorrow, salvation, eternal peace truth (Vyaharika Satya), ultimate truth. The acceptance of various systems of philosophy for realization of truth and complementariness in society in ancient Indian system.
Unit-II	**Aspiration and Purpose of Individual and Human Society: -** Aims of Human life; at individual level and societal level. At societal level; Four Purusarthas Dharma, Artha, Kama, Moksha. Individual level; Abhyudaya (progress), Nihsreyasa (perfection) Pravrtti, Nivrtti. Dharma; Dharma sutras (Gautama, apastamba, baudhayana, vasistha). Dharma-Shastra; (manusmriti, naradamrti,visnusmrti, yajnavalkya smriti) sociology, different stages of life like student hood, householdership, retirement and renunciation, rites and duties, judicial matters, and personal laws (Aachara, Vyavahara, Prayaschitta). Artha; Kautliya Arthashastra, Kamandakiya Nitisara, Brihaspati Sutra, Sukra Niti, Moksha: Human liberation (Ignorance to Knowledge).
Unit-III	**Program for Ensuring Human Purpose: at Individual and Societal level :-** Fundamental concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul). The true constitution

	of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamay Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana). Differentiating Vidya and Avidya, human bondages, Higher and Lower Knowledge (Para Vidhya & Apara Vidhya). Concept of Sattva, Rajas, Tamas and need of balancing the same, Patanjali yog sutra; Yama, Niyama, Asanas, pranayams, pratyahara, dharna, dhyana, Samadhi, Sixteen category of padartha, pramans (pratyaksh, anuman, upaman, shabda). Saadhana chatushtayam (viveka, vairagya, mumukshatavam, shadsampathi (sama, dama, uparama, titiksha, shradha, samadhana), Understanding Nitya karma, Naimittika Karma, Kamya karma, prayaschitta karma, Nishidha Karma. Meditation and Progressive meditation (Narada's education), Ativadin to self-knowledge, Jyan yog, Karma yog, sanyas yog in the aspect of harmonious practice in society.
Unit-IV	**Practices for Ensuring Human Purpose: -** Practice in philosophy, architecture, grammar, mathematics, astronomy, metrics, sociology, economy and polity, ethics, geography, logic, military science, weaponry, agriculture, mining, trade and commerce, metallurgy, shipbuilding, medicine, poetics, biology and veterinary science.

Suggested Readings:

- Ancient Indian Society, Maharaj swami chidatmanjee, Anmol Publication Pvt. Ltd, India
- The Four Values in Indian Philosophy and Culture, Rao, N. 1970. Mysore: University of Mysore.
- Chakraborti, K. 2001. Religious Process: The Puranas and the Making of Regional Tradition, Delhi, OUP.
- The Structure of Scientific Revolutions, (2nd ed.), Kuhn, T. 1970. University of Chicago Press, USA.
- The religion and philosophy of the Veda and Upanishads, Keith, A. (1925). Delhi: Motilal Banarsidass Publishers.
- Culture and History of Ancient India (With Special Reference of Sudras), Supriya Lakshmi Mishra, 2020.
- Religion and Society in Ancient India, Om Prakash, Bhariya Vidhya Prakashan, 1985.
- Introduction to Indian Knowledge System: Concept and Applications by B Mahadevan, Rajat Vinayak,Pavana, RN Nagendra, PHI Learning, New Delhi

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Indian Philosophy	https://www.youtube.com/watch?v=ddJg3gzYEb8
Unit-II	Indian Philosophy (Orthodox & Heterodox Systems)	https://www.nptelprep.in/courses/109106059/videos
Unit-III	Indian Knowledge Systems	https://www.youtube.com/playlist?list=PLRfu94TCePTtVPR-kC4RpIGIwo7-ViCGP
Unit-IV	Philosophy & Consciousness (Sankhya/Yoga Focus)	https://archive.nptel.ac.in/courses/109/106/109106059/

Course Code	**MDE-BBA-107B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Culture and Civilization**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To introduce fundamentals of Ancient Indian Education to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana & Itihasa 2. To help students to trace, identify and develop the ancient knowledge systems. 3. To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing. 4. To build in the learners a deep-rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Remember** core ideas and texts of Indian knowledge traditions.	Level-1Remember
CO2	**Understand** philosophical and scientific foundations of knowledge systems.	Level-2Understand
CO3	**Apply** traditional concepts to interpret science, language, and culture.	Level-3Apply
CO4	**Apply** integrated knowledge to real-life and managerial contexts.	Level-3Apply

Unit No.	**Contents**
Unit-I	**Introduction to IKS:** Caturdaśa Vidyāsthānam, 64 Kalas, Shilpa Śāstra, Four Vedas, Vedāṅga,Indian Philosophical Systems, Vedic Schools of Philosophy (Sāṃkhya and Yoga, Nyaya and Vaiśeṣika, Pūrva-Mīmāṃsā and Vedānta), Non-Vedic schools of Philosophical Systems (Cārvāka, Buddhist, Jain), Puranas (Maha-puranas,Upa-Puranas and Sthala-Puranas), Itihasa (Ramayana, Mahabharata), NitiSastras, Subhasitas
Unit-II	**Foundation concept for Science & Technology:** Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (BhūtaSaṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa,Saṃśaya
Unit-III	**Indian Mathematics & Astronomy in IKS:** Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of $\pi\pi$, Trigonometry, Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar, Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System, Astronomical Instruments (Yantras) Jantar Mantar or Raja Jai Singh Sawal.

Unit-IV	**Indian Science & Technology in IKS:** Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas), Metals and Metalworking technology (Copper, Gold, Zinc, Mercury, Lead, and Silver), Iron & Steel, Dyes and Painting Technology, Town & Planning Architecture in India, Temple Architecture, Vastu Sastra, **Humanities & Social Sciences in IKS:** Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing, Yoga way of life, Indian approach to Psychology, the Triguṇa System, Body-Mind-Intellect- Consciousness Complex. Governance, Public Administration & Management, reference to Ramayana, Artha Sastra, KauṭilyanState

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
- Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central Chinmay Mission Trust, Bombay, 1995.
- Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: HindologyBooks, 2008.
- SK Das, The education system of Ancient Hindus, Gyan Publication House, India
- BL Gupta, Value and distribution system in India, Gyan Publication House, India
- Reshmi Ramdhoni, Ancient Indian Culture and Civilisation, Star Publication, 2018
- Supriya Lakshmi Mishra, Culture and History of Ancient India (With Special Reference to Sudras), 2020.
- Gambirananda, Swami, Tr. Upanishads with the Commentary of Sankarachrya. Kolkata: Advaita Ashrama Publication Department, 2002.
- Ranganathananda, Swami. The Message of the Upanishads. Bombay: Bharathya Vidya Bhaven, 1985.
- Om Prakash, Religion and Society in Ancient India, Bharatiya Vidya Prakashan,1985

UsefulVideoLinks:

Unit No	Topics	Links
Unit-I	Introduction to Indian Knowledge Systems (Philosophy & Culture)	https://www.youtube.com/watch?v=5f0phlOdYvU
Unit-II	Ayurveda & Traditional Medicine in Indian Knowledge Systems	https://www.youtube.com/watch?v=xORzinU4oC8
Unit-III	Indian Contributions to Mathematics (Ancient Mathematics & Systems)	https://www.youtube.com/watch?v=T0gCkyKVQUg
Unit-IV	Indian Astronomy & Calendar Systems	https://www.youtube.com/watch?v=JpZBaHsQ2Ws

Course Code	**MDE-BBA-109B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Science, Engineering and Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To familiarize learners with major sequential development in Indian science, engineering and technology. 2. To review & strengthen the ancient discovery and research in physics, chemistry, maths, metallurgy, astronomy, architecture, textile, transport, agriculture and Ayurveda etc. 3. To help students to trace, identify and develop the ancient knowledge systems to make meaningful contribution to development of science today 4. To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the scientific, technological and holistic development of physical, mental and spiritual wellbeing.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Recall** key ideas, historical contributions of traditional knowledge systems.	Level-1Remember
CO2	**Understand** the principles, cultural knowledge creation and practice.	Level-2Understand
CO3	**Apply** traditional scientific concepts to explain natural phenomena, health, and technology.	Level-3Apply
CO4	**Apply** integrated knowledge to relate traditional practices with contemporary life and sustainability.	Level-3Apply

Unit No.	**Contents**
Unit-I	**Indian Traditional Knowledge; Science and Practices:** Introduction to the Science and way of doing science and research in India, Ancient Science in Intra & Inter Culture Dialogue & coevolution. Traditional agricultural practices, Traditional water-harvesting practices, Traditional Livestock and veterinary Sciences, Traditional Houses & villages, Traditional Forecasting, Traditional Ayurveda & plant-based medicine, Traditional writing Technology
Unit-II	**Ancient Indian Science (Physics, Chemistry, Maths):** Physics in India: Vaisheshika darshan atomic theory & law of motion, theory of panchmahabhoota, BrihathShathaka (divisions of the time, unit of distance, Bhaskara Chaya (theory of gravity, Surya Siddhanta & sidhantashriomani), Lilavati (gurutvakashan Shakti). Chemistry in India Vatsyayana, Nagarjuna,Khanda, Al-Biruni, Vagbhaṭa –building of the ras-shala (laboratory), working arrangements of ras-shala, material and equipment, Yaśodhara Bhaṭṭa-process of distillation, apparatus,saranasamskara, saranataila Mathematics in India: Baudhayana's Sulbasutras, Aryabhaṭa, Bhaskaracharya-I, Severus Sebokht, Syria, Brahmagupta, Bhaskaracharya-II, Jyeṣṭhadeva.

Unit-III	**Ancient Indian Science (metallurgy, Astronomy, Architecture):** Metallurgy in India: Suvarna(gold) and its different types, prosperities, Rajata(silver), Tamra(copper), Loha(iron), Vanga(tin), Naga / sisa(lead), Pittala(brass), Astronomy in India Vedang Jyotish, Aryabhata Siddhanta, Mahabhaskriya, Laghubhaskriya, vatesvarasiddhanta, Sisyadhivrddhida, Grahashyay,Goladhyaya, Karabakutuhala**(**Aryabhaṭa, Varahamihira, Brahmagupta,Vaṭesvara, Bhaskara, Paramesvara, NilakaṇṭhaSomayaji, Jyeṣṭhadeva, ŚankaraVarman). Architecture in India: Nagara (northern style), Vesara (mixed style), and Dravida (southern style), Indian vernacular architecture, Temple sytle, cave architecture, rock cut architecture, kalinga architecture, chandels architecture, Rajput architecture, jain architecture, sikh architecture, Maratha architecture, Indo-Islamic architectural, Indo-Saracenic revival architecture, Greco-Buddhist style.
Unit-IV	**Ancient Indian Science (Textile, Agriculture, Transport):** Textile Technology in India: Cotton (natural cellulose fiber), silk, wool (natural protein fibres), bast and leaf fibres, mridhudhautadhupitambaram (meaning a practice of fumigating the fabric with incence smoke before use as a part of the finishing process), Sitadhautavasanayugala (bleached white–a finishing process); suchhastah, sutradharah (needle and thread – tools for stitching).dyeing, washing spinning and weaving technology,Agriculture in India: Krishi suktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land- devamatruka, Nadimatruka, use of animals in warfare, animal husbandry, Animals for medicines. Ancient transport in India. **Ancient Indian Science (Ayurveda & Yoga):** Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha Bhuta, the communication between body & mind, health regimen for wellbeing, introduction to yoga (raja yoga, astang yoga, Gyanyoga), understanding of Indian psychological concept, consciousness, tridosha & triguna.

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
- Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatva Bodh of Shankaracharya, Central Chinmay mission trust, Bombay, 1995.
- SK Das, The education system of Ancient Hindus, Gyan publication house, India
- R P Kulkarni, Glimpse of Indian Engineering and Technology (Ancient & Medieval period, Munshi ram Manohar Lal Publishers Pvt. Ltd. 2018
- AK Pathak, Science and Technology in India, Anshika Prakashan pratapgarh, 2016
- PB Sharma, S. Narain, Doctors Scientists and Engineers of Ancient India, Kalpaz Publications 2017
- Anonyms, History of Science in India- Volume-I Part-I (Physics, Mathematics and Statistics), the national academy of science, India & the Ramkrishna mission institute of culture, 2014
- Dharmpal, Indian science and technology in the eighteen century, rashtrottahana sahitya, 1983
- S Biswal, B L ray, Vedic Science and technology, DK Print world, 2009
- A.K Bag, History of technology in Indian (Set 3 vol), Indian Nation Science Academy, 1997.
- AR Vasudev Murty, Science and Technology in Ancient India as Reflected in the Mahabharata, Sanskrit Bharati, 2019

UsefulVideoLinks:

Unit No	Topics	Links
Unit-I	Indian Traditional Knowledge & Research Culture	https://archive.nptel.ac.in/courses/121/106/121106003/?
Unit-II	Ancient Indian Science (Physics, Chemistry, Maths)	https://www.youtube.com/watch?v=T0gCkyKVQUg
Unit-III	Ancient Indian Science (Metallurgy, Astronomy, Architecture)	https://www.youtube.com/watch?v=r5KTrbJlKAA

Course Code	**MDE-BBA-111B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Town Planning and Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1.To develop the knowledge and understanding of eco-friendly, robust and scientific planning and architecture system of ancient India. 2.To help the learners to trace, identify and develop the approach, process and material used in town planning, construction and architecture. 3. To understand the various eco-friendly technologies accepted in ancient civilization.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Recall** the concepts related to human settlements and architectural traditions.	Level-1Remember
CO2	**Explain** how culture, environment, and human needs influence built forms.	Level-2Understand
CO3	**Apply** principles of form, space, and materials in architectural examples.	Level-3Apply
CO4	**Apply** analytical understanding to compare regional and period-based architectural practices.	Level-3Apply

Unit No.	**Contents**
Unit-I	**The Introduction to ancient Architecture:** Introduction to relationship between Man, Nature, Culture and city forms. Study of determinants (Natural and man-made) influencing location, growth &pattern of human settlements including types of settlements growth (Organic and planned) and settlement forms. Architecture as satisfying human needs: functional, aesthetic and psychological outline of components and aspects of architectural form-site, structure, skin, materials, services, use, circulation, expression, character, experience. Understanding of the causative forces - the cultures, history, socio religious practices and institution, political and economic conditions, issues of land, climate and technology, Historical and Primitive Architecture.
Unit-II	**Ancient Architecture as Expression of Art & Design:** Relationship between Art and Design with man, space and environment. Expression in Art and Architecture – concept of space, sense of enclosure, openness, robustness, dynamism, spatial geometry, Eco-friendliness. Architecture through the use of elements of visual arts such as point, line, plane, form, space, colour, texture, light, solids and voids, shadow and shade etc. Understanding of effect of scale, proportions, order, material effects such as textures, patterns, light, sound, temperature etc in architectural spaces. Allied visual and performing arts and its relationship to built environments using colour theory, symbolism, glass painting, scriptural writing, clay moulding, stone carving. Important Indian architecture as per elements space & form. **Form:** specific geometry form (sphere, cube, pyramid, cylinder and cone and its sections as well as their derivatives) **Space:** build form space, open space, Internal and External space, Continuous spaces Centralized, Linear, Radial Clustered, clustered, grid space. Different types of Materials used for construction in ancient Indian architecture. **Clay products:** Classification of bricks, Fire Brick, Fly Ash Bricks, Tiles, Terracotta, Earthenware, Porcelain, Stoneware. **Stones:** Uses of Stones, Qualities of Good Building Stones, Dressing, Common Building Stones of India. **Glass:** Different glass Forms and their Suitability, **Timber**: Different Forms and their suitability, **Metals:** Ferrous & Nonferrous Metals and Alloys, and, their Suitability,

	limitations, precautions **Paints and Varnishes:** Different types and their suitability, limitations, and precautions.
Unit-III	**Ancient Architecture Principle & Planning:** Design: Principles of designing – Composition of Plan. Inception and development of the early Hindu temple form with reference to the Vedic and Buddhist planning principles and design elements; Development of regional styles and manifestations thereof; Evolution of temple complexes and temple towns; Planning: Residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors. Vastushastra and its importance in building interrelationships with human, nature, and cosmos Town Planning: Town plans of Harappa, Mohenjo-Daro, Pataliputra, Delhi. Vastushastra and its application in city layout.
Unit-IV	**Ancient Architecture-I:** The settlement planning pattern, elements, associated forms, typical Vedic village, towns (Dandaka, Nandyavartha etc.), typology of Shelters and civic buildings of ancient architecture in reference to the following civilisations: Indus Valley, Aryan/Vedic Civilisation, Buddhist Architecture, Indo Aryan & Dravidian Architecture. Role of Shilpasastras and Arthashastra in settlement planning. Important architecture: Great baths, Development of fortification, walled towns, structures developed e.g., stupas, Viharas, Chaityas, Stambhas, Torana, sacred railings, etc. Study of worshipping places with especial reference to Indo Aryan / Nagara style & Dravidian style (Chola, Chalukya, Pallava, Satavahana, Hoysala, Vijayanagar, etc.), design of shikharas & gopuram, rock-cut and structural examples of temples. **Ancient Architecture-II:** Evolution of Hindu Temples in different period: Gupta, Aihole, Badami, Pattadakkal, Mahabalipuram, Indo Aryan Style in Orissa, Khajuraho, Gujarat, Rajasthan. Dravidian Style in Chola, Chalukyan, Pandya, Pallava, Hoysala Style, Revival of Hindu architecture of South India at Vijay nagara and Madurai Tradition Indian villages & House: Regional house construction, interior &importance e.g. Rajasthani house, bhungas of Kutch, nalukettu of Kerala, Ikraof assam, manduvalogili or illu of Andra Pradesh, Wadas of Maharashtra, Mudhouses of Madhya Pradesh, kathkuni of Himachal Pradesh, khanjaghara of orisha, Taq and dhajjidiwari of Kashmir etc. Scientific achievements though ancient architect: Jantar Mantar, MusicalPillars of Vitthal temple, Sundial of Konark temple, construction of eight shiva temple in straight line from Kedarnath to Rameshwaram at longitude (79°E 41'54"), Veerbhadra temple with 70 hanging pillars, Ellora caves excavating the mountain, Jaipur plan pink city etc.

Suggested Readings:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
- Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatva Bodh of Shankaracharya, Central Chinmay Mission Trust, Bombay, 1995.
- Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
- Dr. V. Ganapati Sthapati, Building Architecture of Sthapatya Veda
- Binode Behari Dutt, Town planning in ancient India, Life Span Publishers & Distributors
- NR Dave, A Study of The Hindu Science of Architecture and its Practice with Special Reference to Raja Vallabha, Bharti Vaidya Bhavan, 2011
- M W Meister, South India Lower Dravida Desa - Encyclopaedia of Indian Temple Architecture (Set of 2 Books)- An Old and Rare Books, American Institute of Indian Studies, 1999
- D N Shukla Civil Architecture in Ancient India (Part-I) Meharchand Lakshmi Das publication, 2016.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Early Architecture & Human Settlements	https://www.youtube.com/watch?v=zq8t_XnJhTQ
Unit-II	Buddhist, Early Temple & Built Forms	https://www.youtube.com/watch?v=zq8t_XnJhTQ
Unit-III	Temple Evolution & Material/Spatial Concepts	https://www.youtube.com/watch?v=7Bx9UYSIIDk
Unit-IV	Historical Examples & Site Planning	https://www.nptelprep.in/courses/124106009/videos?

Course Code	**MDE-BBA-113B**				
Category	Multidisciplinary Courses				
Course Title	**Indian Health, Wellness and Psychology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To understand the fundamental principles of Indian health systems, such as Ayurveda and yoga, which are useful in maintaining the health of a healthy person 2. To understand the traditional way of cleansing the body regularly, strengthening the body with Yogic exercises, and maintaining the internal balance to prevent diseases 3. To understand our unique Mind Body Constitution and choose the right lifestyle suitable to maintain the internal balance. 4. To understand the mind and its dynamics through knowledge of Ayurveda and Yoga, and using the knowledge to maintain harmony between body and mind to achieve perfect mental health.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Recall** fundamental concepts related to human constitution, health maintenance, and mind–body interrelationships.	Level-1Remember
CO2	**Explain** how internal balance, lifestyle practices, and mental factors influence overall wellbeing and immunity.	Level-2Understand
CO3	**Apply** principles of daily and seasonal routines, diet, and self-care practices to promote physical and mental health	Level-3Apply
CO4	**Apply** integrative mind–body principles to enhance resilience, self-awareness, and holistic health in everyday life.	Level-3Apply

Unit No.	**Contents**
Unit-I	**Understanding human body:** Introduction to Ayurveda, the Knowledge of Life, Health and treatment aspects in Ayurveda, Influence of Pancha maha Bhuta on Internal environment of Human being, understanding composition of Human body through the concept of Dosha Dhatu Mala, Understanding Prakruthi, the Mind – Body Constitution.
Unit-II	**Understanding the communication between body & Mind:** Establishing communication between body and mind by understanding the language of body. Understanding the concept of Agni, Koshta, Sara and Ojas and their relevance in enhancing our immunity to protect from various infections. Looking at the world through the lenses of Dravya, Guna and Karma, applying the principle of Samanya and Visesha in every aspect of life to achieve perfect health.
Unit-III	**Introduction to Health Regimen:** Understanding Swasthavritta, the healthy regimen to maintain state of well-being. Dinacharya, the Daily regimen including Daily detoxification, exercise, Intake of Food, Water, Air and Sunlight, work and ergonomics, Rest and sleep hygiene. Ritu charya, the seasonal regimen, Sadvritta and the concept of social well-being, understanding trividhaupastambhas, three pillars to health, Concept of Shadrasa in choosing appropriate

	nourishment to the body and mind.
Unit-IV	**Introduction to Yoga:** Definition, Meaning and Objectives of Yoga, Relevance of Yoga in the Modern Age. Brief Introduction of Hatha yoga, Raja yoga, Karma yoga, Gyana Yoga, Bhakti yoga. Understanding the eight steps of Ashtanga yoga, Understanding Shatkriyas, the six cleansing procedures of Yoga. **Introduction to Indian Psychology:** Concept of Manas in Ayurveda and understanding Mind Body harmony, Triguna-based Psychology in Ayurveda and Yoga, Influence of Tri dosha on Mind, mind-body-intellect and consciousness complex, Understanding consciousness and solution to issues within Human Mind.

Suggested Readings:

- The Charaka Samhita
- The Susruta Samhita
- Teh Ashtanga Hridaya
- Dr Deepak Chopra, Perfect Health--Revised and Updated: The Complete Mind Body Guide, Harmony publication, 2001
- Vasant lad, Ayurveda, the Science of Self-healing: A Practical Guide: Science of Self- healing, lotus press, 1984
- The Hatha yoga pradipika
- The Patanjali yoga sutras
- The Gheranda Samhita
- BKS Iyengar, Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority, Thronson Publication, 2006.
- Swamy Satyananda Saraswati, Asana, Pranayama, Mudra and Bandha, Bihar School of Yoga, 2002.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introductory Concepts & Roots of the Tradition	https://www.youtube.com/watch?reload=9&v=16-q-V9lG5w&embeds_referring_euri=https%3A%2F%m%2F
Unit-II	Human Body, Constitution & Balance	https://www.youtube.com/watch?v=ty9ZfluxOFk&embeds_referring_euri
Unit-III	Healthy Living & Well-Being (Daily/Seasonal Regimen)	https://www.youtube.com/watch?v=9AJseqmcrfQ

Course Code	**CC-BBA-102B**				
Category	Core Courses				
Course Title	**Human Behaviour and Organization**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1.To understand the concepts and foundations of organizational behavior. 2. To develop knowledge of individual behaviour, personality, perception, and motivation. 3. To familiarize students with group dynamics, team behavior, and conflict management. 4. To develop an understanding of leadership, power, organizational culture, and stress management.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the fundamental concepts, models, and scope of organizational behavior in contemporary organizations.	Level-1Remember
CO2	**Explain** individual, group, and organizational factors influencing behavior, motivation, leadership, and workplace culture.	Level-2Understand
CO3	**Apply** organizational behavior approaches to improve teamwork, motivation, leadership effectiveness, communication, and stress management.	Level-3Apply
CO4	**Analyze** behavioral dynamics, motivation, leadership styles, stress management, organizational culture, and interpersonal relationships for organizational effectiveness.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to Human Behavior and Organization:** Meaning, importance, and historical development of organizational behavior; Factors influencing organizational behavior; Contributing disciplines of OB; OB models. Emotional Intelligence and Interpersonal Relationships at the Workplace.
Unit-II	**Individual Behavior:** Foundations of Individual Behavior; Personality- determinants of personality, Type A and B, Big Five personality types, stages of personality development; Attitude - components, job-related attitudes; Learning- concept, theories, and reinforcement; Perception - concept, perceptual process, factors influencing perception; Values - concept and types: terminal values and instrumental values. Motivation – Concept, importance, and theories of motivation- Early Theories of motivation (Need Hierarchy, Theory X and Theory Y, Two-Factor Theory); Contemporary Theories of motivation (Self-Determination Theory, Goal-setting Theory, Reinforcement Theory, Self-efficacy Theory).
Unit-III	**Group & Team Behaviour:** Groups and Work Teams: Concept: Five-Stage model of group development; Groupthink and shift; Indian perspective on group norms, Group, and teams; Types of teams; Creating team players from individual building. Individual & Group conflict; e-teams.

Unit-IV	**Leadership & Power:** Leadership: Concept; Trait theories; Behavioral theories (Ohio and Michigan Studies) Contingency theories, Authentic leadership, mentoring, self-leadership; Inspirational Approaches (transformational, charismatic): Comparison of Indian leadership styles with other countries. Bases of Power. **Organizational Culture:** Concept of culture; Impact (functions and liability); Creating and sustaining culture: Employees and culture; Creating positive and ethical cultures; Need and importance of Cross-Cultural management, Stress, and its Management.

Suggested Readings:

- Organizational Behavior by Robbins, Stephen, Prentice Hall of India Ltd., New Delhi.
- Organizational Behavior: An Evidence-Based Approach by Luthans Fred, McGraw Hil Publishers Co. Ltd., New Delhi.
- Organizational Theory Behavior, by Prasad, L.M, Sultan Chand &Sons, New Delhi.
- Organization Behavior by Rao, VS P, Himalaya Publishing House.
- Organizational Behavior by Aswathappa. K., Himalaya Publishing House, Mumbai,18th Edition.
- Organisational Behaviour by Shilpa Goel, Thakur Publishers, Lucknow
- Organisational Behaviour by FC Sharma, Shree Mahavir Book, New Delhi

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Organizational Behaviour	http://digimat.in/nptel/courses/video/110106145/L01.html
Unit-II	Perception	http://digimat.in/nptel/courses/video/110106145/L06.html
Unit-III	Group Dynamics	http://digimat.in/nptel/courses/video/110106145/L48.html
Unit-IV	Power and Leadership	http://digimat.in/nptel/courses/video/110106145/L43.html
	Organizational Culture	http://digimat.in/nptel/courses/video/110106145/L51.html

Course Code	**CC-BBA-104B**				
Category	Core Courses				
Course Title	**Marketing Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand the fundamental concepts, functions, and environment of marketing. 2. To develop knowledge of consumer behavior, market segmentation, targeting, and positioning strategies. 3. To familiarize students with product, pricing, promotion, and distribution decisions in marketing. 4. To develop awareness of service marketing and emerging trends in contemporary marketing.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Define** the fundamental concepts, scope, environment, and contemporary trends of marketing in diverse markets.	Level-1Remember
CO2	**Describe** consumer behavior, market segmentation, targeting, positioning, product, pricing, promotion, distribution, and service marketing strategies.	Level-2Understand
CO3	**Apply** marketing concepts and strategies in real business situations related to market analysis, customer behavior, product and brand management, pricing, promotion, distribution, service, digital, rural, green, and social marketing.	Level-3Apply
CO4	**Analyze** marketing environments, consumer behavior, product and service strategies, and emerging marketing practices for effective decision-making and organizational growth.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	**Contents**
Unit-I	**Introduction:** Nature, Scope and Importance of Marketing, Evolution of Marketing; Core marketing concepts; Company orientation - Production concept, Product concept, Selling concept, Marketing concept, Holistic marketing concept; Marketing Environment: Demographic, Economic, Political, Legal, Socio-cultural, Technological environment (Indian context); Market and competition analysis, Market Analysis and Creating and Delivering Customer Value. types of marketing (B2C, B2G, B2B, C2C).
Unit-II	**Segmentation, Targeting and Positioning:** Concept; Levels of Market Segmentation, Basis for Segmenting Consumer Markets; Consumer Behavior, The Rise of Consumer Democracy, Stimulus Response Model of Consumer Behavior, Buyer's Cultural, Social, Personal, and Psychological Characteristics particularly in Indian context, Consumer Buying Decision Process, Business

	Customer's Buying Decision Process, and Traditional vs. Experiential Marketing's View of Customer.
Unit-III	**Product Decisions**: Concepts and Strategies of Product Life Cycle (PLC), Product Classification, Product Line Decision, Product Mix Decision, Branding Decisions, Packaging & Labelling. Portfolio approach – Boston Consulting Group (BCG) matrix. Introduction to Brand Management, Innovation and New Product Development. **Pricing Decisions:** Determinants of Price, Pricing Methods (Non-mathematical treatment), and Adapting Price. **Promotion Decisions:** Factors determining promotion mix, Promotional Tools –Fundamentals of advertisement, Sales Promotion, Public Relations & Publicity and Personal Selling. **Marketing Channel Decision:** Channel functions, Channel Levels, Types of Intermediaries: Wholesalers and Retailers, Introduction to Retail Management. Retail and Commerce Innovations like Quick Commerce (Q-Commerce), Omnichannel Retailing.
Unit-IV	**Marketing of Services:** unique characteristics of services, marketing strategies for service firms – 7Ps. **Contemporary and Ethical Issues in Marketing:** E-commerce, Digital Marketing, Integrated Marketing, Online Payments, Rural Marketing, Social Marketing, Green Marketing, AI and Technology-Based Marketing, Sustainable Marketing, Ethical AI and Privacy-Centric Marketing, Ethics and Social Responsibility in Marketing, Career Opportunities in Marketing and Skills Required for Success in the Marketing Profession.

Suggested Readings:

- Marketing Management (16th edition) by Kotler P., Keller K., et al., Pearson Education Pvt. Ltd.
- Strategic Market Management: Global Perspectives by Aaker, D. A. and Moorman Christine., John Wiley & Sons.
- Marketing Management by Shainesh G. Kotler Philip, Keller Kevin, Alexander Chernev, Jagdish N. Sheth, Pearson Higher Education.
- Principles of Marketing (17th edition) by Kotler, P., Armstrong, G., and Agnihotri, P. Y. Pearson Education.
- Marketing Management: Indian Context Global Perspective (6th edition) by Ramaswamy, V.S. & Nama Kumari, S., Sage Publications India Pvt. Ltd.
- Does Marketing Need Reform? Fresh Perspectives on the Future by Sheth, J. N., & Sisodia, R. S. (Eds). Routledge.
- Strategic Integrated Marketing Communications by Percy, L., Routledge.
- Digital Marketing (7th edition) by Chaffey, D., & Ellis-Chadwick, F., Pearson Higher Education.
- Strategic Market Management: Managing Markets for profit and growth by Biswas A. K., Notion Press.
- Marketing Concepts and Strategies by Briak William, Biztantra Publication, New Delhi
- Marketing Management by FC Sharma, Shree Mahavir Book, New Delhi

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Marketing Management	https://www.digimat.in/nptel/courses/video/110104068/L01.html
Unit-II	Market Segmentation, Targeting, and Positioning	https://digimat.in/nptel/courses/video/110107147/L23.html
Unit-III	Pricing Products and Service	https://digimat.in/nptel/courses/video/110107147/L39.html
Unit-IV	Characteristics of service	http://www.digimat.in/nptel/courses/video/110105078/L04.html

Course Code	**CC-BBA-106B**				
Category	Core Courses				
Course Title	**Business Economics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	3	1	0	**4**	
Course Objectives	The objectives of this course are To understand the fundamental concepts and principles of microeconomics and macroeconomics. To familiarize students with demand, supply, production, and consumer behavior concepts. To develop the ability to analyze market structures and price-output determination. To develop awareness of national income concepts and challenges of the Indian economy.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define the** fundamental concepts, principles, and scope of microeconomics and national income in the context of the Indian economy.	Level-1Remember
CO2	**Describe** demand and supply analysis, consumer and producer behavior, market structures, national income concepts, and economic challenges in India.	Level-2Understand
CO3	**Apply** economic theories and analytical tools to examine consumer behavior, production decisions, pricing, market outcomes, and macroeconomic issues in real economic situations.	Level-3Apply
CO4	**Analyse market** dynamics, economic indicators, production and cost structures, and contemporary economic challenges for informed economic decision-making.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Fundamentals and Basic Elements of Microeconomics:** The Economic Problem: Scarcity and Choice, Nature and Scope-Positive and Normative Economics, Scope of Study and Central Problems of Micro and Macroeconomics**.** **Demand Schedule:** Individual and Market Demand Curve, Determinants of Demand, Law of Demand, Movement and Shift among Demand Curve, Elasticity of Demand. **Supply Schedule:** Individual and market supply, determinants of supply, law of supply, Elasticity of supply. Determination of demand and supply, effect of a shift in demand and supply.
Unit-II	**Producer And Consumer Behavior:** Theory of Production-Factors of Production, Production Function, Law of Variable**,** Proportions, Returns to Scale, Producers' Equilibrium. **Theory of Cost:** Short Run and Long Run Average, Marginal and Total Cost Curves. **Cardinal Utility Approach:** Law of Diminishing Marginal Utility, Law of Equi-Marginal Utility, Indifference Curves, Budget Lines and Consumer Equilibrium.
Unit-III	**Analysis of the Market:** Concept of Market and Main Forms of the Market. Price and Output Determination Under Perfect Competition, Monopoly, Monopolistic Competition, and Oligopoly.

Unit-IV	**National Income and Various Indian Economy Challenges:** Circular Flow of Income. Concept of GDP, GNP, NDP, NNP (At Market Price and Factor Cost), Methods of Calculating National Income. **A Brief Introduction of Indian Economy:** Pre-and Post-Independence. **Current Challenges Facing the Indian Economy:** Human Capital Formation, Poverty, Dynamic Business Environment, Trade with Various Nations, Sustainable Economic Development.

Suggested Readings:

- Micro Economics A modern Approach by Varian, H.R.
- Micro Economics Principal, problems & policies by Mc Connell & Brue, McGraw Hills, Professional Publication.
- Micro Economic Theory by Ahuja, H.L., Modern Publisher, Gulab Bhawan, 6, Bahadurshah Zafar Marg, New Delhi.
- Economics by Samuelson & William D. Nordhaus, McGraw-Hill.
- Advanced Micro Economic Theory by M. Maria John Kennedy, Himalaya Publishing House, Delhi.
- Economic Development & Planning in India by Dhingra, I.C. &Garg, V.K.
- Macro Economics by Mithani, D.M., Himalaya Publishing House.
- Macroeconomics by N. Gregory Mankiw.
- Macro Economics Analysis and Policy by TR Jain, V K Global, New Delhi
- Principles of Macroeconomics by Ishwar Dhingra, VK Garg, Sultan Chand and sons, New Delhi
- Microeconomics: Theory and Application by DN Dwivedi, Vikas Publication, New Delhi

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Demand and Supply	http://www.digimat.in/nptel/courses/video/109104125/L07.html
Unit-II	Theory of Production	https://viit.digimat.in/nptel/courses/video/110101005/L17.html
Unit-III	Perfect Competition	https://viit.digimat.in/nptel/courses/video/110101005/L25.html
Unit-IV	Game theory and oligopoly, Measures national income, measuring cost of living	http://www.digimat.in/nptel/courses/video/130106118/L31.html

Course Code	**MDE-BBA-108B**				
Category	Multidisciplinary Courses				
Course Title	**Media Literacy and Critical Thinking**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	1	1	0	**2**	
Course Objectives	The objectives of this course are: 1. To understand fundamental concepts, terms, and principles related to media, communication, and critical thinking. 2. To foster media literacy principles for navigating digital media landscapes and evaluating credibility. 3. To understand media production dynamics and ownership structures in the Indian context. 4. To address ethical and regulatory considerations in media practices.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Define** the fundamental concepts, principles, and significance of media literacy, critical thinking, and digital media in contemporary society.	Level-1 Remember
CO2	**Explain** media forms, media representations, media production and consumption processes, ethical practices, and regulatory frameworks in the Indian context.	Level-2 Understand
CO3	**Apply** media literacy and critical thinking skills to examine media content, audience behaviour, interpret media texts, and navigate digital media responsibly.	Level-3 Apply
CO4	**Analyze** media messages, ownership patterns, ethical issues, regulatory practices, and the impact of digital media on society and communication practices.	Level-4 Analyze

Unit No.	**Contents**
Unit-I	**Foundations of Media Literacy and Critical Thinking:** Core principles of media literacy and critical thinking; Definition and significance of media literacy, its historical evolution within the Indian context; Understanding media as a powerful communication tool and its role in shaping societal perceptions and behaviour.
Unit-II	**Deconstructing Media Texts:** Forms of media texts, including print, broadcast, digital, and social media; Textual analysis and the deconstruction of visual media using semiotics; The impact of media representations on individual perceptions and societal attitudes, from relevant case studies in the Indian context.
Unit-III	**Media Consumption and Production Dynamics:** Dynamics of media production, distribution, and consumption in India: Influence of ownership and control structures on media content; Techniques for critically evaluating media content and analysing audience consumption patterns

Unit-IV	**Ethics, Regulation, and Digital Media Literacy:** Ethical and regulatory considerations inherent in media practices and the evolving landscape of digital media literacy. Ethical principles in media, the regulatory framework governing media content, and the role of self-regulatory bodies in upholding ethical standards; Digital media's impact on contemporary media literacy practices, strategies for navigating online information, and promoting digital citizenship.

Suggested Readings:

- Media Literacy (8th Edition) by W. J. Potter, SAGE Publications.
- Media Literacy in the Digital Age by R. Hobbs, Routledge.
- Thought and Knowledge: An Introduction to Critical Thinking (5th Edition) by D. F. Halpern, Psychology Press
- Thinking, Fast and Slow by Daniel Kahneman, Farrar, Straus and Giroux.
- Media Literacy Education in Action: Theoretical and Pedagogical Perspectives by J. Kahne and B. Bowyer.
- The Media Literacy Handbook by K. Barbour and J. Marshall, ASCD.
- Media Laws and Ethics in India by N. K. Bhaskar, Lexis Nexis.
- The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change (30th Anniversary Edition) by S. R. Covey, Simon and Schuster.
- Media Ethics: Truth, Fairness and Objectivity by Parnjoy Guha Thakurta, Oxford University Press, New Delhi

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Media Literacy: Policy Perspectives, Concept, Need and Scope	https://www.youtube.com/watch?v=39n9sDB0grc
Unit-II	Text, Textuality and Digital Media	http://digimat.in/nptel/courses/video/109102156/L01.html
Unit-IV	Digital and Social Media Marketing	https://www.digimat.in/nptel/courses/video/110107432/L33.html

Course Code	**AEC-BBA-110B**				
Category	Ability Enhancement Courses				
Course Title	**Business Communication-II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	1	1	0	**2**	
Course Objectives	The objectives of this course are: 1. To understand the fundamentals of written, oral, and digital communication in professional environments. 2. To familiarize students with business report writing, corporate communication, and professional etiquettes. 3. To develop effective negotiation, teamwork, and cross-cultural communication skills. 4. To provide practical knowledge of digital communication tools, job search communication, and interview skills.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the fundamentals, types, tools, and significance of written, oral, corporate, cross-cultural, and digital communication in professional settings.	Level-1Remember
CO2	**Describe** business communication practices related to reports, proposals, meetings, negotiations, media usage, professional etiquette, and digital communication platforms.	Level-2Understand
CO3	**Apply** communication skills in professional situations involving business writing, presentations, negotiations, teamwork, interviews, cross-cultural interactions, and digital communication.	Level-3Apply
CO4	**Apply** communication strategies, ethical practices, professional etiquettes, cross-cultural communication skills, and digital media tools for effective organizational and professional communication.	Level-3Apply

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each)from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Written communication: intra organizational/ departmental/ workplace Communication:** Need and Types, Basics of Writing Office Circulars, Agenda, Notice, Office Memoranda, Office Orders, News Letters; Positive and Negative Messages, Use of Technology for Communication, Effective IT communication tools- Electronic mail: advantages, safety and smartness in writing email, E-mail etiquettes; Use of online social media for communication and Public Relations; Ethical dilemmas in use of social media for communication. **Report Writing:** Types of Business Reports, responding to request for proposals (RFP), response to RFP, Formal Report- Components and Purpose, Organizing Information- Outlining & Numbering Sections, Section Headings, Sub-Headings, &Presentation; Reporting in Digital Age, Writing Reports on Field Work/Visits to Industries, Business Proposals; Summarizing Annual Reports of Companies- Purpose, Structure and Principles; Drafting Minutes of a Meeting;

	Corporate Communication: channels of corporate communication, target segments of corporate communication, types of corporate communication; Managing Crisis-Communication; Managing communication during change; Culture as communication
Unit-II	**Oral Communication, Professionalism and Teamwork:** Meaning, Nature, and Scope of Effective Oral Communication; Techniques of Effective Speech, Media for Oral Communication- Face-to-Face Conversation, Teleconferences, Press Conference, Telephonic Conversations, Radio Presentation, Public address and Podcast. Constructing Oral Report, Group Discussion, Teams communication; Communication during online meeting; Online and offline professional etiquette; Conducting appraisals, conducting interviews.
Unit-III	**Negotiation Skills and Cross-Cultural Communication:** Negotiation communication with vendors, suppliers, employees and other stakeholders; BATNA & communication during negotiations; Body language and negotiation; Impact of globalization on organizational communication; Cross-Cultural frameworks (ex. Geert Hofstede); Culture & appropriate communication; Etic and Emic approaches to Culture; Communication to a diverse workforce; Overcoming barriers and biases in Cross-Cultural Communication; Building Inter-Cultural Workplace Skills; Cross-cultural etiquettes across clusters/countries.
Unit-IV	**Contemporary Communication:** Digital communication- individual communicating via social media, organizations communicating via social media, Media Literacy; Strong Digital communication skills –email, instant messaging, video conferencing, e-meetings, digital collaboration, digital citizenship –digital etiquettes & responsibilities; Introduction to personal and organizational websites; communication through podcasts. Job Searching in Digital Age; Creating Resume (CV, cover letter), Creating Customized Cover Messages for Job Applications, Purposes and Types of Employment Interviews, Performing Optimally in a Job Interview- Do's and Don'ts Before, During and After the Interview.

Suggested Readings:

- AICTE's Prescribed Textbook: Communication Skills in English (with Lab Manual), Anjana Tiwari, Khanna Book Publishing Co.
- Lesikar, R.V. & M.E. Flatley, "Business Communication: Connecting in a Digital World", McGraw-Hill Education.
- Murphy, H. A., Hildebrandt, H. & Thomas, J.P. Effective Business Communication. McGraw Hill.
- Mukerjee H. S.,Business Communication: Connecting at Work. Oxford Publication.
- Boove, C.L. et al., Business Communication Today, Pearson.
- Business Communication by Meenakshi Raman, Prakash Singh, Oxford Higher Education, New Delhi
- Business Communication by Urmila Rai , Himalaya Publishing House, New Delhi
- Business Correspondence and Report Writing by RC Sharma, Krishna Mohan, TMH, New Delhi

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to communication in organizations	http://digimat.in/nptel/courses/video/110105052/L01.html
Unit-II	Oral Presentation	http://digimat.in/nptel/courses/video/109104031/L33.html
Unit-III	Negotiation Skills	https://viit.digimat.in/nptel/courses/video/109107121/L16.html
Unit-IV	Introduction of Digital Communication System	http://www.digimat.in/nptel/courses/video/117105144/L01.html

Course Code	**AEC-BBA-108B**				
Category	Additional Course				
Course Title	**Hindi**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	1	1	0	**2**	
Course Objectives	The objectives of this course are: 1 विद्यार्थियों को हिन्दी भाषा के महत्त्व एवं गुणवत्ता से सुविज्ञ करवाकर हिन्दी की ओर उन्मुख करना। 2 विद्यार्थियों को हिन्दी भाषा की वैज्ञानिकता के विषय में बतलाकर इसके गौरव से सुपरिचित करवाना। 3 हिन्दी भाषा के माध्यम से नवयुवक- नवयुवतियों को राष्ट्रीयता के पुनीत भावों की ओर उन्मुख करना।				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	लिपि भाषा और साहित्य के बुनियादी सिद्धांतों का अवलोकन करें।	Level-1 Remember
CO2	भाषा की संरचनाए अर्थ और अभिव्यक्ति के पहलुओं की समझ विकसित करें।	Level-2 Understand
CO3	भाषाई और साहित्यिक सिद्धांतों को वास्तविक जीवन में लागू करने की क्षमता प्राप्त करें।	Level-3 Apply
CO4	भाषा लिपि और साहित्य के विभिन्न पहलुओं का विश्लेषण करके जटिल साहित्यिक और सांस्कृतिक मुद्दों को समझें।	Level-4Analyze

Unit No.	Contents
Unit-I	**लिपि का मानकीकरण**, मानक वर्णमाला, देवनागरी अंक माला, अनुस्वार और विसर्ग, अनुनासिक, वर्तनी की शुद्धता के लिए ध्यान देने योग्य बातें वर्तनी संबंधी अशुद्धियों के कारण वर्तनी संबंधी अशुद्धियों को दूर करने के उपाय
Unit-II	**सृजनात्मक साहित्य का अर्थ**, परिभाषा और स्वरूपः आलोचनात्मक साहित्य का अर्थ, परिभाषा और स्वरूपः सृजनात्मक साहित्य का भाषा विकास में महत्त्व, निबंध लेखन, कहानी लेखन, काव्य लेखन
Unit-III	**अनुवाद अर्थ,** परिभाषा और स्वरूपय अनुवाद का महत्त्व, अनुवादक के गुण, अनुवाद के प्रकार अनुवाद में कंप्यूटर का योगदान, सीरियलों का हिंदी अनुवाद, बैंकिंग साहित्य का अनुवाद, डबिंग क्षेत्र में अनुवाद, लिप्यंतरण, हिंदी साहित्य का अन्य भाषाओं में अनुवाद, अनुवाद क्षेत्र में रोजगार
Unit-IV	**पत्र प्रस्तुतीकरण का अर्थ** पत्र प्रस्तुतीकरण और नवीन शोधात्मक वैचारिकता पत्र प्रस्तुतीकरण और शिक्षक की भूमिका, प्रस्तोता का मनोबल, वक्तृत्व कला का विकास शोधात्मक अभिरुचि का विकास

Suggested Readings:

- शुद्ध लेखन और हिन्दी का मानक रूप डॉ० हरिश्चन्द्र वर्मा, विद्या भारती, संस्कृति शिक्षा संस्थान कुरुक्षेत्र (हरियाणा)
- बृहत् हिन्दी कोशः, सम्पा० कालिका प्रसाद, राजवल्लभ सहाय, मुकुन्दीलाल श्रीवास्तव, ज्ञानमण्डल लिमिटेड, वाराणसी
- परिशोध, मुख्य सम्पादक, डॉ० लक्ष्मीनारायण शर्मा, मानव- मूल्य विशेषांक 1993
- भारतीय जीवनमूल्य, डॉ० धर्मपाल मैनी, भारतीय संस्कृति संस्थान, गुड़गाँव
- बृहत् प्रशासन शब्दावली, हिन्दी-अंग्रेजी, वैज्ञानिक तथा तकनीकी शब्दावली आयोग, नई दिल्ली-110006
- बृहत् प्रशासन शब्दावली, अंग्रेजी-हिन्दी वैज्ञानिक तथा तकनीकी शब्दावली आयोग, नई दिल्ली-110006
- बृहत् पारिभाषिक शब्द-संग्रह, मानविकी, खंड-1 वैज्ञानिक तथा तकनीकी शब्दावली आयोग, केन्द्रीय हिन्दी निदेशालय शिक्षा तथा समाज कल्याण मंत्रालय, भारत सरकार
- प्रयोजनमूलक अनुवाद, डॉ० सुरेश सिंहल मोनिका प्रकाशन, दिल्ली-110053
- अनुवाद सिद्धान्त एवं व्यवहार, डॉ० सुरेश सिंहल, अभिनव प्रकाशन, दिल्ली-6

Useful Video links:

Unit No	Topics	Links
Unit-I	लिपि का मानकीकरण	https://www.youtube.com/watch?v=g1jcWLojnj4&t=2s
Unit-II	सृजनात्मक साहित्य का अर्थ	https://www.youtube.com/watch?v=aUOgArzWtTU
Unit-III	अनुवाद	https://www.youtube.com/watch?v=B1-xF-WBDXI
Unit-IV	प्रस्तुतीकरण का अर्थ	https://www.youtube.com/watch?v=NkXI3lgDkrw

Course Code	**VAC-BBA-104B**				
Category	Value Added Courses				
Course Title	**Indian Constitution**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	2	0	0	**2**	
Course Objectives	The objectives of this course are: 1. To develop an understanding of the Indian Constitution beyond legal and political lenses, emphasizing its significance for business students 2. To recognize the importance of comprehending constitutional basics and their impact on trade, economy, and business practices 3. To understand the transition from state-led industrialization to liberalization, highlighting the constitutional underpinnings of these economic shifts. 4. To analyse the inclusion of economic justice in the preamble and its implications for post-colonial economic policies.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the constitutional foundations of the Indian economy, including constitutional design, economic justice, fundamental rights, duties, and fiscal federalism.	Level-1Remember
CO2	**Describe** constitutional provisions, economic regulations, fiscal structures, and landmark developments influencing business and trade in India.	Level-2Understand
CO3	**Apply** constitutional and economic principles to examine business regulations, fiscal issues, trade provisions, and contemporary economic case studies in India.	Level-3Apply
CO4	**Apply** constitutional provisions and judicial perspectives to examine the impact of economic policies, regulatory frameworks, and landmark judgments on business and the Indian economy.	Level-3Apply

Unit No.	Contents
Unit-I	**An Economic History of the Constitution of India:** Historical understanding of the constitution as an economic document. Understanding the Preamble, starting from the land reform cases in the 1950s to the validity of the bitcoin ban imposed by the RBI, this module signpost all of the important economic moments in the constitutional history of post-colonial India; Constitutional design, Legal**,** Regulation and economic justice.
Unit-II	**Fundamental Rights and Business in India:** Article 19(1)(g), grants every citizen the right, to practise any profession, or to carry on any profession, occupation, trade, or business. Like other fundamental rights, this right is subject to reasonable restrictions impose by the state. This particular provision of the Constitution has been one of the most severely litigated freedoms. Fundamental Duties.
Unit-III	**Fiscal Federalism:** Article articles 301 to 307 of the Constitution pertains to Trade, Commerce and Intercourse within the Territory of India; Challenges associated with fiscal federalism in India including the vertical fiscal imbalance; Article 280 of the Constitution.
Unit-IV	**Constitutional Battles that Shaped the Economy:** This module will be taught through key case studies that demonstrate the complex and fascinating overlap between the constitution and business and shall use Saurabh Kirpal's book Fifteen Judgments: Cases that Shaped India's Financial Landscape as our guide through this landscape. The case studies include the banning of diesel engine cars, Telecom regulation and ownership of broadcast media, Demonetisation, Aadhaar, the lifting of

	restrictions on dealing in cryptocurrencies.

Suggested Readings:

- The Oxford Handbook of the Indian Constitution by Sujit Choudhry, Madhav Khosla and Pratap Bhanu Mehta, Oxford University PressCases.
- Rustom Cavasjee Cooper v. Union of India, (1970) 1 SCC 248.
- State of Rajasthan v. Mohan Lal Vyas, AIR 1971 SC 2068.
- Mithilesh Garg v. Union of India, (1992) 1 SCC 168; AIR 1992 SC 221.
- Chintamanrao v. State of Madhya Pradesh, AIR 1951 SC 118.
- Cooverjee B. Bharucha v. Excise Commissioner, Ajmer, AIR 1954 SC 220.
- T. B. Ibrahim v. Regional Transport Authority, Tanjore, AIR 1953 SC 79.
- Harman Singh v. Regional Transport Authority, Calcutta, AIR 1954 SC 190.
- Dwarka Prasad Laxmi Narain v. State of U.P., AIR 1954 SC 224.
- State of Bombay v. R. M. D. Chamarbaugwala, AIR 1957 SC 699.
- Parbhani Transport Co-operative Society Ltd., Regional Transport Authority, Aurangabad, AIR 1960 SC 801.
- State of Bombay v. R. M. D. Chamarbaugwala, (1957) SCR 874.
- G. K. Krishnan v. State of Tamil Nadu, (1975) 1 SCC 375.
- Automobile Transport (Rajasthan) Ltd. v. State of Rajasthan, AIR 1962 SC 1406.
- Introduction to The Constitution of India by Durga Das Basu, LexisNexis

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Background, History & Framing of the Constitution of India	https://www.youtube.com/watch?v=rs1D1rIfhWM
Unit-II	Fundamental Duties	https://nptel.ac.in/courses/129105608
Unit-III	Finance Commission under Article 280	http://kcl.digimat.in/nptel/courses/video/129105410/L27.html
Unit-IV	Saurabh Kirpal's book Fifteen Judgments: Cases that Shaped India's Financial Landscape	https://youtu.be/IA55pZ9IBmk?si=fH5bBxn2dsKCrsQ4

Course Code	**SEC-BBA-102B**				
Category	Skill Enhancement Courses				
Course Title	**Emerging Technologies and Applications**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	1	0	2	**2**	
Course Objectives	The objectives of this course are: 1. To understand the concepts and models of cloud computing and emerging technologies. 2. To familiarize students with IoT, Industry 4.0, blockchain, and AR/VR applications in business. 3. To develop knowledge of security, governance, and data management in digital technologies. 4. To provide insights into the impact of emerging technologies on business processes and decision-making.				
Formative Assessment	20 Marks (Theory) + 10 Marks (Practical)				
Summative Assessment	50 Marks				
Practical/Viva Voce	20 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Define** the concepts, models, technologies, and applications of cloud computing, IoT, Industry 4.0, block chain, and AR/VR in business environments.	Level-1 Remember
CO2	**Describe** cloud services, IoT systems, Industry 4.0 technologies, blockchain mechanisms, AR/VR applications, and related security, governance, and regulatory aspects.	Level-2 Understand
CO3	**Apply** emerging technologies for business process optimization, smart manufacturing, real-time decision-making, customer engagement, and digital transformation.	Level-3 Apply
CO4	**Analyse** the impact of cloud computing, IoT, Industry 4.0, blockchain, and AR/VR technologies on business models, operations, security, and organizational performance.	Level-4Analyze
CO5	**Evaluate** cloud platforms, decentralized applications, and emerging technology solutions for deployment, scalability, security, and business requirements through practical applications.	Level-5Evaluate
CO6	**Develop** basic cloud-based and blockchain-enabled applications using contemporary digital platforms and tools.	Level-6Create

Note:

1. Examiner will set nine questions in total. Question one will have 5 short questions of 2 marks (each) from all units. Remaining eight questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	**Contents**
Unit-I	**Cloud Computing:** Cloud service models (IaaS, PaaS, SaaS) – Deployment models (public, private, hybrid)- Cloud-based -enterprise solutions – Cost-benefit analysis and scalability – Security and Governance – Data security and compliance in the cloud – Cloud governance frameworks.

Unit-II	**Internet of Things (IoT) & Industry 4.0:** Sensor technologies and connectivity - IoT Applications in Smart cities and infrastructure – Industrial IoT and manufacturing – IoT data processing and storage – Real-time analytics and decision-making – Concept of Industry 4.0 – Automation and smart manufacturing – Cyber-physical systems and digital twins – Robotics and advanced manufacturing technologies – Impact on Business Models – Transformation of production and supply chains – Business process optimization.
Unit-III	**Block chain Technology:** Fundamentals of Block chain – Decentralization and distributed ledger – Cryptography and consensus mechanisms – Smart contracts – Financial services and digital identity– Challenges and Opportunities – Security and privacy issues – Regulatory and compliance considerations.
Unit-IV	**Augmented Reality (AR) and Virtual Reality (VR):** Introduction to AR/VR – Key concepts and differences between AR and VR – Historical development and current state - AR/VR applications in marketing and customer experience – Training and development through immersive technologies – Challenges and Opportunities – Technological limitations and advancements – Integration with existing business processes.

Lab/Practical:

- Hands-on sessions on utilizing popular cloud platforms for development and deployment, offering hands-on experience with free tiers and trial accounts.
- Hands-on sessions on blockchain technologies, focusing on the basics development and deployment of decentralized applications.

Suggested Readings:

- Emerging Technologies by Errol S. van Engelen.
- Internet of Things by Jeeva Jose, Khanna Book Publishing.
- Digital Transformation: A Strategic Approach to Leveraging Emerging Technologies by Anup Maheshwari.
- Virtual & Augmented Reality by Rajiv Chopra, Khanna Book Publishing.
- Emerging Technologies for Effective Management by Rahul Dubey, Cengage Publications.
- IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Jerome Henry, Rob Barton, Gonzalo Salgueiro and Patrick Grossetete.
- Blockchain for Business by Jai Singh Arun, Jerry Cuomo and Nitin Gaur.
- Blockchain& Crypto Currencies by Anshul Kausik, Khanna Book Publishing.
- Industry 4.0 Technologies for Business Excellence: Frameworks, Practices, and Applications by Edited By Shivani Bali, Sugandha Aggarwal, Sunil Sharma.
- Blockchain, Artificial Intelligence, and the Internet of Things: Possibilities and Opportunities by Pethuru Raj, Ashutosh Kumar Dubey, Abhishek Kumar, Pramod Singh Rathore.
- Cloud Computing Bible by Barrie Sosinsky,wiley India, New Delhi
- Internet of Things by Raj Kamal, MGH, New Delhi

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Cloud Computing Overview	http://www.digimat.in/nptel/courses/video/106105167/L01.html
Unit-II	Basics of Industrial IoT	http://kcl.digimat.in/nptel/courses/video/106105195/L21.html
Unit-III	Block chain Technology	http://www.digimat.in/nptel/courses/video/106104220/L01.html

Course Code	**CC-BBA-201B**				
Category	Core Courses				
Course Title	**Cost and Management Accounting**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To familiarize the learners with the basic concepts and processes used to determine product costs and ascertain material, labour, and overhead costs. 2. To enrich the knowledge of the learners in knowing and applying various tools like ratio analysis, cash flow statement, marginal costing for analyzing the financial statements for managerial information. 3. To provide a basic understanding of budgetary control. 4. To develop the knowledge of the learners to understand and prepare a management report.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** fundamental concepts of cost and management accounting.	Level-1Remember
CO2	**Describe** the cost and management accounting fundamental concepts and its application.	Level-2Understand
CO3	**Apply** the cost and management accounting methods and techniques in business decision-making.	Level-3Apply
CO4	**Analyze** cost and management methods and techniques to support managerial planning and decision-making.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to Cost and Management Accounting:** Definitions, Features, objectives, functions, scope, advantages and limitations. Relationships and differences between Cost accounting, Management accounting and Financial Accounting. Cost Concepts-Cost classification, Elements of cost, Preparation of cost sheet and quotation. Direct and indirect material costs, Inventory control techniques, stock levels, EOQ, ABC analysis. Issue of materials to production pricing methods-FIFO, LIFO and Average methods. Labour cost: direct and indirect labour cost, methods of payment of wages, including incentive plans -Halsey and Rowan plans, Tailors Piece Rate method. **Overheads-** features, classification, methods of allocation and apportionment of overheads, primary and secondary distributions.
Unit-II	**Marginal Costing and Budgetary control:** Marginal Costing-Meaning, Importance, Marginal Cost Equation, Difference between Marginal costing and Absorption costing. **Break-Even Analysis-**Meaning and Importance, Break-Even Chart, P/V ratio, Cost Volume Profit Analysis, Margin of Safety, Angle of Incidence, Problems in Marginal Costing.

	Budgets - Meaning and importance, Budgetary Control-Meaning and Importance, Types of Budgets, Practical Problems, Flexible Budget and Cash Budget.
Unit-III	**Financial Statement Analysis:** Comparative Income Statements and Balance Sheets, Common Size Income Statements and Balance Sheet analysis- Trend Analysis. **Ratio Analysis –** Introduction, Classification & Interpretation of Ratios-Liquidity ratios, Solvency ratios, Proprietary ratios, Profitability ratios, Leverage ratios and Turnover ratios.
Unit-IV	**Cash flow and Fund Flow statement:** Introduction- Concept of Cash, Sources of cash flow, Cash from operations, Cash from Financing and Cash from investment- Inflow and outflow of cash, Preparation of Cash flow statements with adjustments. Preparation of Fund Flow Statements. Cash Flow Statement vs. Fund Flow Statement. **Management Reporting** – Meaning and Definitions of reports, Objectives and Purpose, Reports to top-level management, Reports to lower-level management, Sample Reports.

Suggested Readings:

- Cost and Management Accounting by Arora, M. N.,New Delhi: Himalaya Publishing House.
- Cost Accounting. Principles and Practice by Jain, S.P., & Narang, K.L. New Delhi: Kalyani Publishers.
- Cost and Management Accounting by Kishor, R.M. New Delhi: Taxman Allied Services.
- Cost Accounting by Pillai, R.S.N, Bagavathi, V., New Delhi: Sultan Chand.
- Management Accounting by Arora, M.N. New Delhi: Himalaya Publishing House.
- Cost Accounting: Test, Problems and Cases by Lal, J. Srivastav, Seema., Singh, Manisha. New Delhi: Tata McGraw Hill Education.
- Cost and Management Accounting by Mittal, S.N., Shree Mahavir Publications.
- A Textbook of Cost and Management Accounting by Arora, M.N., Vikas Publication.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Labour Cost	http://digimat.in/nptel/courses/video/110106511/L05.html
Unit-II	Break-Even Analysis	http://www.digimat.in/nptel/courses/video/105106653/L17.html
Unit-III	Introduction to Financial Accounting and Cost Accounting	https://nptel.ac.in/courses/110106368
Unit-IV	Cash Flow Statement	http://www.digimat.in/nptel/courses/video/110101003/L11.html

Course Code	**CC-BBA-203B**				
Category	Core Courses				
Course Title	**Legal and Ethical Issues in Business**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To provide students with an understanding of key legal and ethical issues in the business context of India. 2. To analyze ethical dilemmas in business decisions 3. To understand the legal and regulatory aspects of business ethics that concern the financial, competitive and charitable responsibilities of organisations. 4. To gain knowledge about how organizational and individual factors impact business ethics.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** major laws, regulations, and ethical principles that guide business conduct.	Level-1Remember
CO2	**Explain** legal and ethical challenges in business operations using relevant case studies.	Level-2Understand
CO3	**Apply** legal frameworks and ethical principles to examine business practices and decision-making.	Level-3Apply
CO4	**Analyze** ethical dilemmas and organizational situations to propose appropriate solutions aligned with ethical issues and corporate social responsibility.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to Business Law:** Business law – definition, scope, importance of understanding the role of law in business; Elements of a contract – offer and acceptance, consideration, contractual capacity; Essentials of a valid contract; Types of contracts; Performance obligations; Types of contract breaches and remedies; Product liability and consumer protection laws; Business torts; Employment law.
Unit-II	**Sales and Leases:** Formation of Sales Contract: Contracts for Leasing Goods, Title and Risk of loss, Performance and remedies, Warranties and Product liability; Introduction to Negotiable Instruments, Negotiability, Negotiation and Holders in due course; Liability and discharge, Bank customer Relations/Electronic Fund Transfers.
Unit-III	**Introduction to Business Ethics:** The definition and importance of business ethics, business ethics in the Indian context; Institutionalization of Business Ethics in the organization, benefits of Ethical Conduct in Business, Ethical Issues and Stakeholder Concerns; Social Responsibility and Regulatory Framework: Corporate social responsibility; Environment & business; Issues related to Business Ethics in marketing, finance & human resource functions. Ethical responsibilities of

	multinational corporations; Ethical dilemmas facing businesses globally, including issues related to discrimination, human rights, environmental impact, and intellectual property.
Unit-IV	**The Ethical Decision-making process:** Philosophical approaches to ethical decision making; Ethics & Religious approaches; Moral & Legal aspects of ethical decision making: Ethical aspects in Bhagvat Gita; Kautaliya's Arthshastra; Swami Vivekanand on Ethics; Swami Vivekanand's message to the youth of India; Ethical Decision Making in Organizations: Individual and Organizational Factors Influencing Ethical Decisions; Karmyog, Indian philosophy of work ethics; Kautilya's Arthshastra; Introduction to Integral Humanism; Ethical Decision-Making Frameworks to Improve Decision-Making Outcomes; Corporate Governance and its Impact on Ethical Decision-Making; Whistle blowing; Conflict Resolution.

Suggested Readings:

- Business and Corporate Laws by Tulsian, P. C., S. Chand Publishing.
- Business Ethics and Corporate Governance by Fernando, A.C., Pearson.
- Business Law Beyond Business by Bayern, S., J. Corp. L., 46, 521.
- To the Youth of India by Vivekanand, S., Advaita Ashrama.
- Business Ethics: An Indian Perspective by Fernando, A C; Muraleedharan, K P; Satheesh, E K., Pearson Education.
- Business Laws by Mittal, S.N., Shree Mahavir Publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Concept, Elements, Importance and Forms of Contracts	https://nptel.ac.in/courses/110105159
Unit-II	Law of Sale of Goods	http://www.digimat.in/nptel/courses/video/129106006/L38.html
Unit-III	Corporate Social Responsibility	https://nptel.ac.in/courses/110105159
Unit-IV	Ethical Decision Making	http://www.digimat.in/nptel/courses/video/110105079/L14.html

Course Code	**CC-BBA-205B**				
Category	Core Courses				
Course Title	**Human Resource Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand how HR plays a functional role, needed for organizational effectiveness and management. 2. To understand the difference between functional and strategic roles of HR. 3. To analyse the need for HR planning, Innovation, the use of technology, and sector-specific HR needs. 4. To understand the innovation in HRM and best practices.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the concepts of HRM in organizational management.	Level-1Remember
CO2	**Describe** HRM practices related to employee life cycle, recruitment, training, talent and career management, compensation, performance management, workplace relations, HR technology, and innovations.	Level-2Understand
CO3	**Apply** HRM techniques for workforce planning, employee development, performance evaluation, compensation, engagement, compliance, and management of virtual, gig, and diverse employees.	Level-3Apply
CO4	**Analyze** HR strategies, HR analytics, workplace practices, organizational transformation, leadership, innovation, sustainability, and employee relations for organizational effectiveness.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 mark (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first question is compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**The Nature of HRM:** Human Resource Management—An Introduction; Human Resource Business**,** Partnership HRM; HRM policies, HRM in globally competitive environment; Functional HRM; strategic human resource management. Career Opportunities in Human Resource Management and Skills Required for Success in HR profession.
Unit-II	**Plan, Acquire, Develop, Career Management:** Employee life cycle approach, Human Resource Planning; Recruitment and Selection; Training and Development; Competency Management; Career Management; Talent Management, Managing the GIG employees and Virtual employees and team.
Unit-III	**Engagement, Performance, compensation management, Industrial Relations, Compliance, Employment relations:** Changing nature of Employee Engagement; Performance Management; Compensation and Benefits; Compensation for Special Groups, Industrial Relations; Workplace Laws and Regulations; Employment Relations.

Unit-IV	**Technology, HR Analytics, Innovation:** Human Resource Information and Analytics; Human Resource Management Innovations; Human Resource Management in Small and Medium Enterprises; Human Resource Management in the Service Sector, Organization Transformation and the Human Resource Leadership; Diversity, Equity and Inclusion; Workplace Wellness, sustainability goals and HRM, Green HRM and challenges.

Suggested Readings:

- Human Resource Management by DeNisi, A.S. ,Griffin,R.W and Sarkar,Anita, Cengage Learning.
- Human Resource Management: Concepts, Practices, and New Paradigms by Sengupta Amitabha.
- Managing Human Resources by Cascio, Wayne F., Tata McGraw Hill, New Delhi.
- Fundamentals of Human Resource Management by DeCenzo, David A, and Stephan P. Robbins, Wiley India, New Delhi.
- Human Resource Management by Bhattacharyya, Dipak Kumar, Excel Books, New Delhi.
- Human Resource Management by Aswathapa, K., TMH Publications.
- Human Resource Management by Gupta, C.B., Sultan Chand and Sons.
- Human Resource Management by Rao, V.S.P. Excel Book.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	The Evolution and Role of HR Function	http://acl.digimat.in/nptel/courses/video/110101164/L01.html
Unit-II	Recruitment and Selection	http://www.digimat.in/nptel/courses/video/110107492/L20.html
Unit-III	Compensation Management	http://www.digimat.in/nptel/courses/video/110107492/L50.html
Unit-IV	HR Analytics	http://www.digimat.in/nptel/courses/video/110107492/L01.html

Course Code	**MDE-BBA-201B**				
Category	Multi-Disciplinary Elective Course				
Course Title	**Indian Systems of Health and Wellness**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	1	1	0	**2**	
Course Objectives	The objectives of this course are 1. To understand the importance of a healthy lifestyle. 2. To familiarize students with physical and mental health. 3. To create an awareness of various lifestyle-related diseases. 4. To provide an understanding of stress management.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the fundamental concepts of health and wellness.	Level-1 Remember
CO2	**Describe** the dimensions of health, determinants of health behaviour, wellbeing, nutrition deficiencies, common diseases, digital wellbeing, and indigenous health perspectives.	Level-2 Understand
CO3	**Apply** health and wellness practices for maintaining physical, mental, social, and spiritual well-being and preventing lifestyle-related diseases.	Level-3 Apply
CO4	**Apply** wellness approaches, healthy lifestyle practices, nutrition awareness, and Indian health systems to improve individual and community well-being.	Level-3 Apply

Unit No.	Contents
Unit-I	**Introduction to Health & Wellness:** Definition of Health**,** Importance of health in everyday life**,** Components of health – physical, social, mental, spiritual and their relevance. Concept of wellness**,** Mental health and wellness**,** Determinants of health behaviour.
Unit-II	**Mind Body and Well-Being:** Mind-body connection in health – concept and relation**,** Implications of mind-body connection**,** Wellbeing – why it matters? Digital wellbeing.
Unit-III	**Deficiency & Diseases:** Malnutrition, undernutrition and overnutrition**,** Body system and common diseases**,** Sedentary lifestyle and risk of disease**,** Modern lifestyle and associated health risks.
Unit-IV	**Indian system of well-being:** Health beliefs of India**,** Health systems in India – AYUSH. Perspective of indigenous people towards health**,** Happiness and well-being in India.

Suggested Readings:

- Positive Psychology: The science of happiness and human strength by Carr, A., UK: Routledge.
- Lifestyle Disease: Lifestyle Disease management by C. Nyambichu & Jeff Lumiri.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Mental health and wellness	http://digimat.in/nptel/courses/video/109103182/L17.html
Unit-II	Mind Body	http://www.digimat.in/nptel/courses/video/110101165/L34.html
Unit-III	Malnutrition	http://digimat.in/nptel/courses/video/127105532/L17.html
Unit-IV	Happiness and well-being	http://www.digimat.in/nptel/courses/video/109105199/L23.html

Course Code	**VAC-BBA-201B**				
Category	Value Added Course				
Course Title	**Disaster Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	**2**	
Course Objectives	The objectives of this course are 1. To understand the concepts of disasters, hazards, risks, and vulnerabilities. 2. To understand various natural and man-made disasters and their impacts. 3. To understand disaster management strategies, including planning, response, and recovery. 4. To understand the relationship between development, climate change, and disaster risk reduction.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Recall** key concepts of disasters, man-made disasters, disaster management, and their link to development and vulnerability.	Level-1 Remember
CO2	**Describe** the disaster types, impacts, disaster management phases, disaster risk reduction strategies, policies, legislation, and emergency response mechanisms	Level-2 Understand
CO3	**Apply** the disaster management practices, preparedness planning, risk reduction measures, and emergency response techniques in disasters and crises.	Level-3 Apply
CO4	**Analyze** disaster risks, vulnerabilities, management strategies, policies, and emergencies to support effective disaster preparedness and recovery.	Level-4 Analyze

Note:

1. All the theoretical contents shall be delivered through the practical workshop mode only. No classroom teaching is encouraged in this course. The list of experiments may be designed by the course coordinator in consultation with the Head of Department.
2. Training and Demonstration Workshops (at least two workshops) will be organized in association with the NIDM, NDRF, NCDC, Paramilitary, Fire Brigade, CISF, local administration, etc.

Unit No.	Contents
Unit-I	**Concepts and Terminologies:** Understanding key concepts of Hazards, disasters; Disaster types and causes (Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made); Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmental and Psychosocial); Defining Vulnerability (Physical Vulnerability; Economic Vulnerability; Social Vulnerability).
Unit-II	**Key concepts of Disaster Management Cycle:** Components of disaster management cycle (Phases: Response and recovery, Risk assessment, Mitigation and prevention, Preparedness planning, Prediction and warning); Disaster risk reduction (DRR), Community-based disaster risk reduction.
Unit-III	**Initiatives at the National and International level:** Disaster Risk Management in India and at the international level: Related policies, plans, programmes and legislation; International strategy for disaster reduction and other initiatives.
Unit-IV	**Emergency Management:** Explosion and accidents (Industrial, Nuclear, Transport and Mining) - Spill (Oil and Hazardous material); Threats (Bomb and terrorist attacks) - Stampede and conflicts**.**

Suggested Readings:

- Disaster Management by Sharma, S.C., Khanna Book Publishing.
- Disasters and Public Health: Planning and Response by Clements, B. W., Elsevier Inc.
- Disaster Management and Human Health Risk: Reducing Risk, Improving Outcomes by Dunkan, K., and Brebbia, C. A., (Eds.), WIT Press, UK.
- Natural Hazards and Disaster Management: Vulnerability and Mitigation by Singh, R. B. (ed.), Rawat Publications, New Delhi.
- Geological Hazards: Causes, Consequences and Methods of Containment by Ramkumar, Mu, New India Publishing Agency, New Delhi.
- Managing Natural Disaster: Hydrological, Marine and Geological Disasters by Modh, S., Macmillan, Delhi.
- Disaster Management: A Disaster Management Handbook by Carter, N., Asian Development Bank, Manila.
- Govt. of India Vulnerability Atlas of India. BMTPC, New Delhi.
- Govt. of India Disaster Management in India. Ministry of Home Affairs, New Delhi.
- Natural Hazards and Environmental Change by Matthews , J.A., Bill McGuire, Ian Mason.
- Disaster Management by Goel, Shilpa; Mangla, Dolly; Gupta, Laxmi, Shree Mahavir Publications.
- Disaster Management by Singh, Savindra, Pravalika Publications.

E-Resources

- http://www.ndma.gov.in/en/
- http://nidm.gov.in/
- https://www.unisdr.org/
- http://www.emdat.be
- https://www.weather.gov/safety/
- https://www.preventionweb.net/risk/vulnerability

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Concept of Hazard	https://nptel.ac.in/courses/105104183
Unit-II	Disaster risk reduction (DRR)	http://acl.digimat.in/nptel/courses/video/124107010/L11.html
Unit-III	Disaster Risk Management	https://youtu.be/D7CRK7wMamo?si=C_f-j-Lm8g1WgmDa
Unit-IV	Condensed Phase Explosives and their Properties	http://digimat.in/nptel/courses/video/112106177/L34.html

Course Code	**SEC-BBA-201B**				
Category	Skill Enhancement Courses				
Course Title	**Management Information System**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	2	0	4	**4**	
Course Objectives	The objectives of this course are 1. To understand the fundamental concepts of Management Information Systems, database management, and information system applications. 2. To familiarize students with modern tools and methodologies used in MIS and project management. 3. To develop skills to analyze and design information system solutions for business contexts. 4. To provide practical knowledge to implement effective MIS solutions and manage projects efficiently.				
Formative Assessment	20 Marks (Theory) + 10 Marks (Practical)				
Summative Assessment	50 Marks				
Practical/Viva Voce	20 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define the** fundamental concepts, components, applications, and infrastructure of Management Information Systems and database systems.	Level-1Remember
CO2	**Describe** MIS applications, database management systems, decision support systems, e-business models, project management concepts, and ethical issues in the information era.	Level-2Understand
CO3	**Apply MIS**, DBMS, e-commerce, knowledge management, and agile project management approaches for business decision-making and process improvement.	Level-3Apply
CO4	**Analyze** information systems, database structures, e-business processes, project risks, and digital business practices for organizational effectiveness.	Level-4Analyze
CO5	**Evaluate** real-world MIS implementations, database designs, e-commerce models, and agile project management practices using practical business scenarios.	Level-5 Evaluate
CO6	**Develop** spreadsheets, database systems, ER diagrams, e-commerce websites, and agile project plans for business applications and decision support.	Level-6 Create

Note:

1. Examiner will set nine questions in total. Question one will have 5 short questions of 2 marks (each) from all units. Remaining eight questions of 10 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Fundamentals concepts of MIS:** Basic concepts of MIS/ Types of MIS, Dimension and components of IS, Benefits of MIS, IT infrastructure, and IT infrastructure evolution, Components of IT infrastructure, New approaches for system building in the digital firm era.
Unit-II	**Database management system:** Objectives of database approach- Characteristics of database Management Systems-Data processing system- Components of DBMS packages –Database administration- Entity – Relationship (conceptual).

Unit-III	**Information system applications:** MIS applications, DSS – GDSS - DSS applications in E enterprise – Knowledge Management System and Knowledge-Based Expert System - Enterprise Model System and E-Business, E- Commerce, E-communication, Business Process Reengineering.
Unit-IV	**Managing Projects:** Objectives of project management, Fundamentals of project management information systems with agile methodologies -Introduction of SCRUM, Roles and meetings, User stories, Project risk, Controlling risk factors, Ethical, social, and political issues in the information era.

Lab/Practical:

- Analyze a real-world Management Information System (MIS) implementation case, identifying the types of MIS used, benefits realized, and challenges faced. Present findings using written and visual formats.
- Set up and manage a Database Management System (DBMS), perform basic operations, and create an Entity-Relationship diagram for a business scenario to demonstrate database conceptual design.
- Design and build an e-commerce website, incorporating features of digital markets, digital goods, and e-commerce business models.
- Manage a mock project using agile methodologies, including roles, meetings, user stories, and risk management.

Suggested Readings:

- Management information systems: managing the digital firm by Laudon, K. C., & Laudon, J. P Fifteenth Edition. Pearson.
- Database systems: design, implementation, & management by Coronel, C., & Morris, S.,Cengage Learning.
- Information Systems Project Management (First edition) by Olson, D., US: Business Expert Press.
- The ScrumMaster Study Guide by Schiel, J., Auerbach Publications.
- Fundamentals of information systems by Stair, R., & Reynolds, G. Cengage Learning.
- Management Information System by O, Brien, James A., TMH Publications.
- Management Information System by Mcleod, Raymond, Pearson Education.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Dimensions of Information System	http://www.digimat.in/nptel/courses/video/110105148/L03.html
Unit-II	Introduction to DBMS	http://digimat.in/nptel/courses/video/106105175/L02.html
Unit-III	E-Business	http://www.digimat.in/nptel/courses/video/110105083/L01.html
Unit-IV	Introduction to Agile Project Management	http://www.digimat.in/nptel/courses/video/110104073/L02.html

Course Code	**CC-BBA-202B**				
Category	Core Courses				
Course Title	**Entrepreneurship and Startup Ecosystem**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	1	1	0	**2**	
Course Objectives	The objectives of this course are 1. To understand entrepreneurship, its types, and family business concepts. 2. To identify viable business ideas and prepare business plans. 3. To understand sources of finance and methods of business financing. 4. To learn startup operations, team building, marketing, and business growth strategies.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, characteristics, and significance of entrepreneurship, family business, and start-up ecosystems in economic development.	Level-1 Remember
CO2	**Explain** business opportunity identification, feasibility analysis, venture creation processes, funding sources, and institutional support systems for entrepreneurship.	Level-2 Understand
CO3	**Apply** entrepreneurial approaches to evaluate business opportunities, build ventures, manage operations, utilize digital marketing, and address legal and compliance requirements.	Level-3 Apply
CO4	**Analyze** entrepreneurial ventures, family businesses, start-up ecosystems, funding mechanisms, and technology and intellectual property management for business sustainability and growth.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 mark (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first question is compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to Entrepreneurship & Family Business:** Definition and Concept of entrepreneurship**,** Entrepreneur Characteristics**,** Classification of Entrepreneurs**,** Role of Entrepreneurship in Economic Development –Start-ups**,** Knowing the characteristics of Family business with discussion on few Indian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.
Unit-II	**Evaluating Business opportunity:** Sources of business ideas and opportunity recognition**,** Guesstimating the market potential of a business idea**,** Feasibility analysis of the idea**,** Industry, competition and environment analysis, Design Thinking for Opportunity Identification, Business Model Canvas (BMC).

Unit-III	**Building Blocks for starting ventures:** Low-cost Marketing using digital technologies, Team building from scratch, Venture Funding, Establishing the value chain and managing operations, Legal aspects like IPR and compliance, Growth Hacking and Digital Marketing, Crowdfunding and FinTech Funding.
Unit-IV	**Start-up Ecosystem:** Know the components of the start-up ecosystem, including Incubators, Accelerators, Venture Capital Funds, Angel Investors, etc., and know various govt. schemes like Start-up India, Digital India, MSME, etc. Sources of Venture Funding available in India, Sources of Technology, and Intellectual Property management, Startup India Seed Fund Scheme, AI and Technology-Based Startup Ecosystem.

Suggested Readings:

- Entrepreneurship by Rajeev Roy, Oxford University Press
- Entrepreneurship: Successfully Launching New Ventures by R. Duane Ireland Bruce R. Barringer, Pearson Publishing.
- Family Business Management by Rajiv Agarwal, Sage Publishing.
- Mapping the Startup Ecosystem in India by Anish Tiwari, Economic &Political Weekly.
- Indian Family Businesses: Their survival beyond three generations by Ramachandran, K, ISB Working Paper Series.
- Entrepreneurship by Kaushik, D R; Mishra, Pritisha, Thakur Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Role of Entrepreneurship in Economic Development	https://nptel.ac.in/courses/127105007
Unit-II	Business opportunity	https://nptel.ac.in/courses/110106141
Unit-III	Legal aspects like IPR and compliances	https://nptel.ac.in/courses/127105007
Unit-IV	Venture Funding& Start-up ecosystem	https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_mg81

Course Code	**CC-BBA-204B**				
Category	Core Courses				
Course Title	**Operations Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To understand the concepts and functions of operations management. 2. To develop knowledge of process design, analysis, and capacity planning. 3. To familiarize students with quality management techniques and continuous improvement methods.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, functions, processes, and significance of operations management in organizational effectiveness and customer satisfaction.	Level-1Remember
CO2	**Explain** process design, capacity planning, quality management practices, and emerging trends in operations management.	Level-2Understand
CO3	**Apply** operations management techniques related to process analysis, layout planning, quality improvement, operational efficiency, and sustainable business practices.	Level-3Apply
CO4	**Analyze** operational processes, quality systems, capacity decisions, and emerging technologies to achieve operational excellence and competitive advantage.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 mark (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first question is compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to Operations Management:** Concept of Operations Management, Significance of Operations Management, Organizational Efficiency, Quality and Customer Satisfaction, Production Systems, Alignment of Operations with Business Strategies, Functions of Operations Management, Planning, Organizing, Staffing, Leading, Controlling.
Unit-II	**Process Design and Analysis:** Process Design, Process Selection, Layout Design, Process Analysis, Flowcharts, Process Maps, Continuous Improvement Techniques, Capacity Planning, Balancing Capacity and Demand, Process Choices, Space Utilization, Flexibility, Cost, Safety, Comfort.
Unit-III	**Quality Management:** Quality Concepts, Total Quality Management (TQM), Six Sigma, Lean Manufacturing, Quality Improvement Tools and Techniques, Defect Reduction, Operational Efficiency, Customer Satisfaction, Competitive Advantage.
Unit-IV	**Emerging Trends in Operations Management:** Sustainable Operations, Technology in Operations Management, Artificial Intelligence (AI), Internet of Things (IoT), Global Operations Management, Sustainable Practices, Advanced Technologies, Global Business Environment, Operational

	Excellence. Career Opportunities in Supply Chain Management and Skills Required for Success in Logistics and Operations profession.

Suggested Readings:

- Operations Management by William J. Stevenson.
- Operations Management: Processes and Supply Chains by Lee J. Krajewski, Manoj.
- The Goal: A Process of Ongoing Improvement by Eliyahu M. Goldratt and Jeff Cox.
- Introduction to Operations and Supply Chain Management by Cecil C. Bozarth and Robert B. Handfield.
- Operations Management by Singla Jagdeep; Chand, Suresh, Thakur Publishers.
- Operations Management: Theory and Practice by Mahadevan, B., Pearson Education.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Production	http://www.digimat.in/nptel/courses/video/110107141/L01.html
Unit-II	Process Design and Analysis	https://nptel.ac.in/courses/103106148
Unit-III	Quality and its Dimensions	https://nptel.ac.in/courses/110104080
Unit-IV	Global Operations Management	http://www.digimat.in/nptel/courses/video/110107141/L02.html

Course Code	**CC-BBA-206B**				
Category	Core Courses				
Course Title	**Financial Management**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To apply the knowledge in taking finance decisions. 2. To develop analytical skills to identify financial management problems and solve them. 3. To analyze the relationship among capital structure, cost of capital, dividend decisions, and value of the business. 4. To assess a firm's requirement for long-term assets by applying capital budgeting techniques.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the concepts, objectives, functions, and sources of finance, capital structure, cost of capital, working capital, and capital budgeting.	Level-1Remember
CO2	**Explain** financial management decisions, capitalization theories, leverage concepts, dividend policies, and working capital management practices in business organizations.	Level-2Understand
CO3	**Apply** financial management techniques for financing decisions, capital structure planning, cost of capital computation, leverage analysis, working capital estimation, and capital budgeting decisions.	Level-3Apply
CO4	**Analyze** financing alternatives, capital structure, leverage, working capital requirements, investment proposals, and dividend decisions for effective financial management.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 mark (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first question is compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to Financial Management:** Meaning of finance and financial management, Types of finance, Objective and Scope of financial management– profit maximization and wealth maximization - merits and criticisms- Financial decisions, Internal relation of financial decisions, Factors influencing financial decisions, Functional areas of financial management, Functions of a finance manager, Agency Cost, Definition of ethics and the importance of ethics in Finance, Sources of Finance: Ownership securities – Equity shares, Preference shares, Deferred shares, No par stock/shares, Shares with differential rights, Sweat Equity Creditorship securities – Debentures – Zero coupon bonds, Zero interest bonds, Callable bonds, Deep discount bonds Internal financing

	or ploughing back of profit – short term and long term sources. Startup finance-Bootstrapping, Series Funding.
Unit-II	**Capital Structure & Capitalization:** Meaning of capitalization – Theories of capitalization – cost theory and earnings theory. Over capitalization and under capitalization (Theory) – causes – effects and remedies, Watered stock, Over trading and under trading. Meaning of capital structure and financial structure, principles of capital structure, Optimum Capital Structure, Determinants of capital structure, capital gearing-Theories of Capital structure, Effect of capital structure on EPS, EBIT-EPS Analysis, Point of indifference-Practical Problems.
Unit-III	**Cost of Capital, Leverages and Managing Working Capital:** Meaning of cost of capital, significance of cost of capital, components of cost of capital –Computation of Cost of capital and Weighted Average Cost of Capital, CAPM-Practical Problems. Meaning of Leverage, Types of Leverages – operating, financial and combined leverage, risk and leverage – practical problems. Managing working Capital - Meaning of working capital, types of working capital, working capital cycle, adequate working capital, determinants of working capital, estimation of working capital-Practice problems. Management of cash. Management of inventory and debtors.
Unit-IV	**Capital Budgeting and Dividend policy:** Meaning of Capital Budgeting, Importance, Need, Time value of money-Present and Future Value (Simple Problems), Capital budgeting process, project appraisal by using traditional methods and modern methods, Practical problems on Payback Period, Net Present Value, Profitability Index, IRR and MIRR methods, Dividend policy-Meaning, Kinds, Theories of dividend decisions, determinants of dividend policy decisions, Companies Act, 2013 and SEBI Guidelines on Dividend Distribution.

Suggested Readings:

- Financial Management by Khan, M, Y, & Jain, P, K. Tata Mc Graw Hill.
- Financial Management by Chandra, P. New Delhi, India. Tata McGraw Hill Book Co.
- Financial Management by Pandey, I.M. New Delhi, India. Vikas Publishing House.
- Financial Management by Kumar, A. Khanna Publishing House.
- Financial Management by Gupta, S, K., Sharma, R.K. & Gupta, N. Kalyani Publishers.
- Financial Management by Khan, M, Y, & Jain, P, K. Tata Mc Graw Hill.
- Fundamentals of Financial Management by Brigham and Houston. Cengage Learning.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Fundamentals of Financial Management	http://digimat.in/nptel/courses/video/110107144/L05.html
Unit-II	Capital Structure	https://youtu.be/sSdDej6jpBs?si=tRaaWY-PqTPdgeh0
Unit-III	Cost of Capital	http://www.digimat.in/nptel/courses/video/110106511/L01.html
Unit-IV	Capital Budgeting	http://digimat.in/nptel/courses/video/110107144/L25.html

Course Code	**CC-BBA-208B**				
Category	Core Courses				
Course Title	**Business Research Methodology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are 1. To develop an understanding of the fundamental concepts, types, processes, and ethical principles of research. 2. To enable students to identify and formulate research problems, review literature, and design appropriate research methodologies. 3. To familiarize students with measurement techniques, scaling methods, and various data collection tools used in research. 4. To develop analytical skills for data interpretation, hypothesis testing, and presentation of research findings using statistical and visualization techniques.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Define** the basic concepts, types, and ethics of research.	Level-1Remember
CO2	**Explain** the process of formulating research problems and research designs.	Level-2Understand
CO3	**Apply** research methods and techniques for designing studies, collecting data, constructing scales, and conducting hypothesis testing.	Level-3Apply
CO4	**Analyze** research data using appropriate statistical tests, sampling techniques, coding methods, and data visualization tools for interpretation and decision-making.	Level-4Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 mark (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first question is compulsory and selecting one from each Unit.

Unit No.	**Contents**
Unit-I	**Introduction to Research:** Definition of Research, History and Evolution of Research, Scientific Inquiry, Types of Research, Ethical Considerations in Research, Research Process, Characteristics of Good Research, Components of Good Research Work.
Unit-II	**Formulating the Research Problem:** Identification of Research Problems, Formulation of Research Problems, Literature Review, Research Questions, Research Objectives, Research Design, Process of Developing Effective Research Designs.
Unit-III	**Measurement and Data Collection:** Measurement and Scaling, Types of Data, Sources of Measurement Error, Scale Construction Techniques, Data Collection Methods, Questionnaire Method, Interview Method, Observation Method.

Unit-IV	**Data Analysis and Interpretation:** Sampling Methods, Data Preparation, Editing, Coding, Hypothesis Testing, Parametric Tests, Non-Parametric Tests, Data Visualization Techniques, Charts, Tables, Box Plots.

Suggested Readings:

- Marketing research by Malhotra, N. K., Nunan, D., & Birks, D. F., Pearson UK.
- Research Methodology by Ranjit Kumar.
- Research Methods for Business by Uma Sekaran.
- Methodology of Research by C.R. Kothari.
- Business Research Methods by Sharma, F.C. Shree Mahavir Publications.
- Business Research Methods by Mittal, Ishwar; Ravinder., Thakur Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Research	http://www.digimat.in/nptel/courses/video/121106007/L01.html
Unit-II	Literature Review	http://www.digimat.in/nptel/courses/video/121106007/L06.html
Unit-III	Questionnaire Design	https://youtu.be/f2dBn5XZlZk?si=MrlJApqfLIL-d4xi
Unit-IV	Proposing a Hypothesis	http://www.digimat.in/nptel/courses/video/127106227/L27.html

Course Code	**CC-BBA-210B**				
Category	Core Courses				
Course Title	**International Business**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To understand the fundamentals and theories of international business and trade. 2. To develop knowledge of foreign direct investment and the global business environment. 3. To familiarize students with economic integration, trade blocs, and trade regulations. 4. To develop awareness of emerging trends and ethical issues in international business.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

Cos	Skills Demonstrated	RBT Level
CO1	**Define** the concepts and theories of international business and trade.	Level-1Remember
CO2	**Describe** international trade theories, foreign direct investment, economic integration, trade regulations, and emerging trends in international business.	Level-2Understand
CO3	**Apply** international business concepts and frameworks to examine global trade, FDI decisions, regional integration, and international market opportunities.	Level-3Apply
CO4	**Analyze** international business environments, trade policies, global business strategies, and contemporary challenges affecting global organizations.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 mark (each) from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first question is compulsory and selecting one from each Unit.

Unit No.	Contents
Unit-I	**Introduction to International Business:** Stages of Internationalization, EPRG Framework, International Trade Theories, Mercantilist Theory, Absolute Cost Advantage Theory, Comparative Advantage Theory, Factor Proportions Theory, Neo-factor Proportions Theory, Country Similarity Theory, Intra-industry Trade, Tariff Barriers, Non-Tariff Barriers in Global Business. International Business Management: Professional Opportunities and Industry-Relevant Skills
Unit-II	**Introduction of Foreign Direct Investment:** FDI in the World Economy, Trends in FDI, Theories of Foreign Direct Investment, Greenfield FDI, Brownfield FDI, Benefits and Costs of FDI, International Institutions and Liberalization of FDI, CAGE Model.

Unit-III	**Economic Integration:** Economic Indicators and their Impact on International Business Decisions, Regional Economic Integration, Trade Blocs, Principles of Multilateral Trade Negotiations, Instruments of Trade Regulation, Free Trade Area (FTA), Customs Union, Common Market, Economic Union, Emerging Markets, Developing Economies.
Unit-IV	**Emerging Trends in International Business:** International Entrepreneurship, Born Global Firms, Ethical Considerations in International Business, CSR Frameworks and Approaches, ESG Investing and Reporting Standards, Corporate Responses to Climate Change and Social Justice Issues, Implications of Brexit on International Business Laws, Digital Platforms and E-commerce, Re-shoring and Nearshoring Trends, Impact of Pandemic on International Business.

Suggested Readings:

- International Business: Competing in the Global Marketplace by Charles W. L. Hill.
- International Business: Concept, Environment and Strategy, 3e by Vyuptakesh Sharan Pearson Education.
- International Business: The Challenges of Globalization by John J. Wild and Kenneth L. Wild.
- International Business by Rakesh, M. J. New Delhi, Oxford University Press.
- International Business by Aswathappa, A., 2e. Tata McGraw-Hill Education.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Trade Theories	http://acl.digimat.in/nptel/courses/video/109107173/L05.html
Unit-II	Theories of Foreign Direct Investment	https://youtu.be/k7TYJxWcK9I?si=aBQcoGrjaz8wGEkY
Unit-III	Regional Economic Integration	http://www.digimat.in/nptel/courses/video/109105882/L26.html
Unit-IV	Global Firms Success Strategies	http://www.digimat.in/nptel/courses/video/110107145/L53.html

Course Code	**VAC-BBA-202B**				
Category	Value Added Courses				
Course Title	**Business Environment and Public Policy**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	2	0	0	**2**	
Course Objectives	The objectives of this course are 1. To understand the concepts and dimensions of business environment. 2. To develop knowledge of globalization and international business frameworks. 3. To familiarize students with public policies and economic reforms in India. 4. To develop awareness of economic problems, challenges, and opportunities in business environment.				
Formative Assessment	100 Marks				
Summative Assessment	-				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Define** the concepts, dimensions, policies, and significance of the business environment in the Indian and global context.	Level-1Remember
CO2	**Describe** globalization, economic reforms, public policies, international institutions, and challenges affecting the Indian business environment.	Level-2Understand
CO3	**Apply** business environment concepts and policy frameworks to examine economic reforms, global integration, and business challenges in India.	Level-3Apply
CO4	**Analyze** economic policies, global business trends, and socio-economic challenges influencing business growth and development opportunities in India.	Level-4Analyze

Unit No.	**Contents**
Unit-I	**Theoretical Framework of Business Environment:** Concept, Significance and Nature of Business Environment. Micro and Macro Dimensions of Business Environment, Changing Dimensions of Business Environment. Problems and Challenges of Indian Business Environment.
Unit-II	**Global Framework:** EPRG Framework, Liberalization, Privatization & Globalization concept & its impact on Indian Economy. Significance of FDI & FII, IMF & WTO, Regional Economic Integrations in the development of the Nations.
Unit-III	**Public Policies:** Background, Meaning and Importance of Public Policy. Significance of Industrial Policy, Fiscal Policy, Monetary Policy, Foreign Trade Policy, FERA & FEMA. Structural Adjustment Programs and Banking Sector Reforms in India.
Unit-IV	**Problems and Challenges in Economic Growth:** Unemployment, Poverty, Regional Imbalance. Social Injustice, Inflation, Parallel economy, Lack of technical knowledge and information. Remedies to solve these problems, Challenges & Opportunities of Indian Business Environment.

Suggested Readings:

- Essentials of Business Environment by K. Aswathappa, Himalaya Publishing House.
- Business Environment by Francis Cherunilam, Himalaya Publishing House.

- Business Environment by A. C. Fernando, Pearson.
- Business Environment by Dr. S Sankaran, Margham Publications.
- Business Environment by Dr V Murali Krishna, Spectrum Publications.
- Business Environment by Namitha Gopal, McGraw Hill.
- Business Policy and Environment by Ghosh, P.k.; Kapoor G.k., Sultan Chand and Sons
- Business Environment by Bedi, Suresh, Excel Book Publisher.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Business Environment	http://amrita.digimat.in/nptel/courses/video/110103754/L11.html
Unit-II	Globalization	https://vit.digimat.in/nptel/courses/video/109105113/L01.html
Unit-III	Foreign Trade Policy	https://edurev.in/v/491953/foreign-trade-policy-investment-economic-development
Unit-IV	Problems of Growth in an Economy-Unemployment, Poverty and Imbalances	https://youtu.be/q5W9IBGvYD8?si=WQEYNinLI2nmO048

Course Code	**SEC-BBA-202B**				
Category	Skill Enhancement Courses				
Course Title	**Design Thinking and Innovation**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	1	1	0	**2**	
Course Objectives	The objectives of this course are 1. To understand the concepts and process of design thinking and innovation. 2. To develop creative problem-solving and customer-centric thinking skills. 3. To familiarize students with ideation, prototyping, and implementation techniques. 4. To develop skills in feedback analysis and innovative solution design.				
Formative Assessment	30 Marks				
Summative Assessment	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	**Define** the concepts, principles, stages, and significance of design thinking, innovation, and customer-centric problem-solving.	Level-1 Remember
CO2	**Explain** empathy, ideation, prototyping, implementation, feedback mechanisms, and user-focused design approaches in the innovation process.	Level-2 Understand
CO3	**Apply** design thinking tools and techniques to identify problems, generate ideas, develop prototypes, and enhance customer experience in business situations.	Level-3 Apply
CO4	**Analyze** customer needs, design challenges, feedback systems, and innovative solutions to improve product and service experiences.	Level-4 Analyze

Note:

1. Examiner will set nine questions in total. Question one will have 7 short questions of 2 marks (each)from all units. Remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first question being compulsory and selecting one from each Unit.

Unit No.	**Contents**
Unit-I	**Basics of Design Thinking:** Concept of Innovation, Significance of Innovation in Business, Creative Thinking Process, Problem Solving Approaches, Design Thinking Approach, Objectives of Design Thinking, Design Thinking and Customer Centricity, Customer Challenges, Enhancing Customer Experience through Design Thinking, Parameters of Product Experience, Alignment of Customer Expectations with Product, Global Success Stories of AirBnB, Apple, IDEO, Netflix, Stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement.
Unit-II	**Learning to Empathize and Define the Problem:** Importance of Empathy in Innovation Process, Development of Empathy using Design Tools, Observation and Assimilation of Information, Individual Differences and Uniqueness, Group Discussions and Activities for Understanding Individual Differences, Wicked Problems, Identification of Wicked Problems, Impact of Solutions to Wicked Problems.

Unit-III	**Ideate, Prototype and Implement:** Ideation Templates, Brainstorming, Systems Thinking, Concept of Brainstorming, Consensus Building on Wicked Problems, Mapping Customer Experience for Ideation, Methods of Prototyping, Rapid Prototyping, Implementation Process.
Unit-IV	**Feedback, Re-Design & Re-Create:** Feedback Loop, User Experience, Ergonomic Challenges, User-Focused Design, Final Concept Testing, Final Presentation, Innovative Design Concepts, Creative Problem-Solving Solutions.

Suggested Readings:

- Developing Thinking Skills (The way to Success) by E Balaguruswamy, Khanna Book Publishing Company.
- Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown, Harvard Business Review.
- 8 steps to Innovation by R T Krishnan & V Dabholkar, Collins Publishing.
- Design Thinking by Nigel Cross, Bloomsbury.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Design Thinking	https://viit.digimat.in/nptel/courses/video/109104109/L01.html
Unit-II	Design Thinking Phases – Empathy	http://www.digimat.in/nptel/courses/video/107107580/L02.html
Unit-III	Brain Storming	https://tkiet.digimat.in/nptel/courses/video/109107155/L33.html
Unit-IV	Creative Problem Solving	https://tkiet.digimat.in/nptel/courses/video/109107155/L15.html

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT

AN AUTONOMOUS INSTITUTE | NAAC 'A' GRADE | AFFILIATED TO MDU ROHTAK

CERTIFICATE COURSE ON DATA ANALYSIS USING EXCEL

SESSION: 2026-2027

Eligibility Criteria: At least senior secondary examination (10+2) with at least 50% marks (47.5% in case of SC/ST/Blind/Visually/Differently abled etc. candidates of Haryana only) from the Board of school education Haryana, Bhiwani or any other examination recognized by Maharshi Dayanand University, Rohtak as equivalent thereto.

Duration: 6 Months (Offering twice in an academic year)

Course Credits: 4

No. of Seats: 30

The reservation of seats is as given below

Sr. No.	Name of Program	Break of seats as per State Govt. Reservation Policy							DA/PwD / PH/ESM / DFF##	EWS**	No. of Sanctioned Seats
		AIC	EWS*	HOGC	SC#		BC (A)	BC (B)			
					OSC	DSC					
1	Certificate Course on Data Analysis Using Excel	4	-	11	3	3	4	3	1	1	30

Note: In the event of vacant seats remaining after the final date of allotment based on reservations, these may be allocated to general category candidates.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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SCHEME AND SYLLABUS OF CERTIFICATE COURSE

Course Code	CC-DAE-01				
Category	Certificate Course				
Course Title	Data Analysis using Excel				
Scheme and Credits	L	T	P	**Credits**	
	3	0	2	**4**	
Course Objectives	The objectives of this course are • To provide students with a comprehensive understanding of data analysis tools using Microsoft Excel. • To enable students to perform descriptive and inferential analysis using Excel for managerial decision-Making. • To equip students with hands-on skills in using Excel for data visualization, pivot tables, trend forecasting, and reporting.				
Assessment	20 Marks				
End Semester Practical	20 Marks				
End Semester Examination	60 Marks				
Total Marks	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	**Define** the basic concepts and tools of Excel.	Level 1: Remember
CO2	**Explain** the applications of Excel in data management and analysis.	Level 2: Understand
CO3	**Apply** Excel tools and functions for business problem-solving.	Level 3: Apply
CO4	**Analyze** business data using advanced Excel tools and reporting techniques.	Level 4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Excel interface and workbook structure**; Data types and cell referencing; Sorting, filtering, and conditional formatting; Data validation, removing duplicates, and flash fill; Named ranges, data import/export.
Unit-II	**Logical functions** (IF, AND, OR, NOT); Lookup functions (VLOOKUP, HLOOKUP, XLOOKUP, INDEX, MATCH); Text functions, Date & Time functions; Statistical functions (AVERAGE, MEDIAN, STDEV, VAR,CORREL).
Unit-III	**Pivot Tables and Pivot Charts**; Data tables and What-If analysis; Goal Seek, Scenario Manager, Solver; Trendlines and forecasting; Regression analysis using Excel's Data Analysis ToolPak
Unit-IV	**Charts:** Column, Line, Pie, Bar, Area, Combo; Sparklines and heat maps; Dashboards with interactive components (Slicers, Timelines); Dynamic reports using form controls; Best practices in Excel-based reporting.

Lab

Excel Interface and Workbook Management, Data Handling and Preparation in Excel, Statistical Analysis using Excel, Dynamic Reports and Excel-Based Reporting Practices, Data Import and Export, Data Management in Excel, Pivot Tables and Pivot Charts.

Suggested Readings:

- Microsoft Excel Data Analysis and Business Modeling by Wayne L. Winston, Microsoft Press
- Excel 2021 Bible by John Walkenbach, Wiley
- Basics of Excel Data Analysis by L. Uman, Sage Publications
- Statistics Using Excel by John E. Freund, Pearson Education
- Excel for Managers (HBR Series) by Harvard Business Review, Harvard Business Review Press

Annexure AC/5.46

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

An Autonomous Institute | NAAC 'A' Grade Institute | Affiliated to MDU, Rohtak

MINUTES OF THE MEETING

Minutes of meeting of the Academic Planning and Execution Committee of the Institute was held on 20th May, 2026

The Meeting of the Academic Planning and Execution Committee of the Institute was held on 20th May, 2026 in the Board Room of the Institute.

The following members were present in the meeting

- Prof. Aman Aggarwal, Director GITAM
- Dr. Vivek Kumar, Registrar
- Dr. Anurag Jain, Head, Department of Applied Science & Humanities.
- Dr. Punam Devi, Head, Department of Management Studies
- Dr. Rakesh Kumar Joon, Head, Department of Electronics & Communication Engineering
- Dr. Nitin Kumar, Head, Department of Computer science & Engineering
- Dr. Jitender Kumar, Head, Department of Fire Technology & Safety
- Mr. Joginder Singh, Head, Department of Electrical Engineering.
- Mr. Vivek, Head, Department of Electrical Engineering.
- Dr. Anil Chillar, Head, Department of Computer Science & Applications
- Dr. Parveen Kumari, Head BCA Deptt
- Dr. Dipika, Head, Department of Business Studies

At the outset, the Director welcomed all the members present in the meeting. After that the Agenda was taken up for the discussion.

Item No. 1 **Approval of AICTE approved Programs for Working Professionals**

The Registrar informed all members of the Academic Committee that the AICTE vide **F.No. North-West/1-46223043271/2026/EOA** on dated 10.04.2026 (**Annexure A/1, Pages 1-6**) has granted the approval to offer the following programs for working professionals:

Level	Program	Course	Working Professional Approved Intake 2026-27
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	CIVIL ENGINEERING	30
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRICAL ENGINEERING	30
POST GRADUATE	ENGINEERING AND TECHNOLOGY	STRUCTURAL DESIGN	15
POST GRADUATE	MANAGEMENT	MCA	30

Further the committee discussed that as per **Clause 10.2 (Page No. 15)** of UGC regulations for Autonomous college (Gazetted notification) "*An autonomous college is free to start a new Degree programme(s) at undergraduate and postgraduate levels with the approval of the Academic Council of the Autonomous College and concerned Statutory Council(s), wherever required provided the nomenclature of the degree is in consonance with UGC Notification on Specification of Degrees, 2014 as amended from time to time. Such courses shall fulfill the minimum standards prescribed by the parent university/UGC/Statutory Council(s) in terms of number of hours, curricular content and standards and the parent University shall be duly informed of such courses*" (**Annexure A/2, Page 7**).

RESOLVED THAT THESE PROGRAMS ARE TO BE OFFERED BY THE INSTITUTE W.E.F. ACADEMIC SESSION 2026-27 AND FURTHER RESOLVED THAT THE SAME IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Item No. 2 **Preparation of the modalities and guidelines for running the Programs for Working Professionals**

The committee discussed on the modalities and AICTE guidelines for running the Programs for Working Professionals in AICTE approved Institutions vide Circular No. AICTE/P&AP/APII/2023-24/01 dated 24.08.2023 and Circular No. AICTE/RB/Misc./2023-24 Dated 21.03.2024 (**Annexure A/3, Pages 8-10**). The modalities and guidelines for running the Programs for Working Professionals will be same as approved by the Academic Council in its 3rd meeting held on 03.07. 2025 vide Resolution No. 3.12 A. However the qualification to take admission in M.Tech Structural Design and MCA program will be same as for the regular students.

Qualification

(a) **M.Tech Structural Design:** B.E./B.Tech or other equivalent degree in Civil Engineering or in any other relevant discipline with 50% (47.50% Marks for SC/ST candidates of Haryana only) Marks in aggregate.

(b) **MCA:** Passed BCA/B.Sc. (Hons.) Computer Science/B.E. or B.Tech. (CSE/IT)/B.Voc.(Software Development/IT) or an equivalent degree with having atleast 50% marks (45% for SC/ST candidates of Haryana only) in aggregate.

OR

Passed B.Sc./B.Com./B.A. with Mathematics at 10+2 level or at Graduation level with having at least 50% marks (45% for SC/ST candidates of Haryana only) in aggregate, along with the students admitted with this eligibility will have to simultaneously undertake additional *bridge course as prescribed by the Institute during the first semester.

Note: * It is compulsory for each student to pass out bridge course (three additional theory papers and one practical as prescribed in scheme of examination of bridge course) as per Institute norms during the 1st year of MCA-2year program. However, these papers under bridge course will be taught only in the 1st semester of the program.

RESOLVED THAT THE MODALITIES AND GUIDELINES MENTIONED ABOVE BE APPROVED AND FURTHER RESOLVED THAT THE SAME IS RECOMMENDED TO ACADEMIC COUNCIL FOR APPROVAL.

Item No. 3 **Academic Calendar for the Academic Year 2026-27**

The Academic Committee discussed and approved the Academic Calendar for the Academic Year 2026-27 **(Annexure A/4, Page 11).**

RESOLVED THAT THE ACADEMIC CALENDAR IS APPROVED AND FURTHER RESOLVED THAT THE SAME IS RECOMMENDED TO THE ACADEMIC COUNCIL FOR APPROVAL.

Registrar

Approved
Director

Annexure AC/5.47

Annexure-4

All India Council for Technical Education

(A Statutory body under Ministry of Education, Govt. of India)

Nelson Mandela Marg,Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org

APPROVAL PROCESS 2026-27

Extension of Approval (EoA)

F.No. North-West/1-46223043271/2026/EOA

Date of Approval: 10-Apr-2026

To,

The Financial Commissioner & Principal Secretary
(Technical) Govt. of Haryana,
Room No. 503/5,
Sector -17 New Secretariat,
Chandigarh-160017

Sub: Extension of Approval for the Academic Year 2026-27

Ref: Online application of the Institution submitted for Extension of Approval for the Academic Year 2026-27

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Education), Powers delegated in AICTE ACT 1987, (No 52 of 1987) chapter II - u/s 2(g) to regulate Technical and subsequent Regulations of AICTE, I am directed to convey the approval to:

Permanent Id	1-8077204	**Application Id**	1-46223043271
Name of the Institution	GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT	**Name of the Society/Trust**	PAWAN GANGA EDUCATIONAL SOCIETY
Institution Address	20 KM MILESTONE, JHAJJAR-BAHADURGARH ROAD VILL. KABLANA, DISTT. JHAJJAR, HARYANA, KABLANA, JHAJJAR, Haryana, 124104	**Society/Trust Address**	4/12, EAST PUNJABI BAGH,NEW DELHI,WEST DELHI,Delhi,110026
Institution Type	Private-Self Financing	**Region**	North-West
Year of Establishment	2008		

To conduct following Programs/Courses with the Intake indicated below for the Academic Year 2026-27

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2025-26	Intake Approved for 2026-27	NRI Approval Status	International Students Approval Status
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	CIVIL ENGINEERING	Maharshi Dayanand University, Rohtak	60	60	No	No
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE & ENGINEERING	Maharshi Dayanand University, Rohtak	60	60	No	No

To conduct following Programs/Courses with the Intake indicated below for the Academic Year 2026-27

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2025-26	Intake Approved for 2026-27	NRI Approval Status	International Students Approval Status
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING	Maharshi Dayanand University, Rohtak	120	120	No	No
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)	Maharshi Dayanand University, Rohtak	60	60	No	No
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)	Maharshi Dayanand University, Rohtak	60	60	No	No
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRICAL ENGINEERING	Maharshi Dayanand University, Rohtak	60	60	No	No
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRONICS & COMMUNICATION ENGG	Maharshi Dayanand University, Rohtak	60	60	No	No
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	FIRE TECHNOLOGY AND SAFETY	Maharshi Dayanand University, Rohtak	60	60	No	No
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	MECHANICAL ENGINEERING	Maharshi Dayanand University, Rohtak	60	60	No	No
POST GRADUATE	MANAGEMENT	MBA	Maharshi Dayanand University, Rohtak	180	150	No	No
POST GRADUATE	COMPUTER APPLICATIONS	MASTERS IN COMPUTER APPLICATIONS	Maharshi Dayanand University, Rohtak	120	90	No	No
POST GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRONICS & COMMUNICATION ENGG	Maharshi Dayanand University, Rohtak	18	18	No	No

To conduct following Programs/Courses with the Intake indicated below for the Academic Year 2026-27

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2025-26	Intake Approved for 2026-27	NRI Approval Status	International Students Approval Status
POST GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE & ENGINEERING	Maharshi Dayanand University, Rohtak	30	30	No	No
POST GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRICAL POWER SYSTEMS	Maharshi Dayanand University, Rohtak	18	18	No	No
POST GRADUATE	ENGINEERING AND TECHNOLOGY	MACHINE DESIGN	Maharshi Dayanand University, Rohtak	12	12	No	No
POST GRADUATE	ENGINEERING AND TECHNOLOGY	STRUCTURAL DESIGN	Maharshi Dayanand University, Rohtak	42	42	No	No
POST GRADUATE	ENGINEERING AND TECHNOLOGY	CYBER FORENSICS AND INFORMATION SECURITY	Maharshi Dayanand University, Rohtak	12	12	No	No
POST GRADUATE	ENGINEERING AND TECHNOLOGY	MANUFACTURING AND AUTOMATION	Maharshi Dayanand University, Rohtak	12	12	No	No

To conduct following Programs/Courses with the Intake indicated below for the Academic Year 2026-27

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2026-27	NRI Approval Status	International Students Approval Status
UNDER GRADUATE	MANAGEMENT	BBA	Maharshi Dayanand University, Rohtak	180	No	No
UNDER GRADUATE	COMPUTER APPLICATIONS	BCA	Maharshi Dayanand University, Rohtak	240	No	No

Note:

A) The approval of BBA/BCA/BMS courses is on "as is where is basis" Intake Approved for BBA/BCA/BMS Course is Subject to the approval of the Concern University.

B) From next year onwards, the EOA will be issued as per the AICTE norms and not on 'As is where is basis'

To conduct following Programs/Courses for Twinning and Collaboration for the Academic Year 2026-27

Level	Program	Course	Affiliation Foreign Body

To conduct following Programs/Courses for Working Professional for the Academic Year 2026-27

Level	Program	Course	Working Professional Approved Intake 2026-27
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	CIVIL ENGINEERING	30
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING	60
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRICAL ENGINEERING	30
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	FIRE TECHNOLOGY AND SAFETY	60
POST GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE & ENGINEERING	60
POST GRADUATE	ENGINEERING AND TECHNOLOGY	STRUCTURAL DESIGN	15
POST GRADUATE	MANAGEMENT	MBA	60
POST GRADUATE	COMPUTER APPLICATIONS	MASTERS IN COMPUTER APPLICATIONS	30

All AICTE approved Institutions are empowered to nurture ecosystems for Skilling (through Vocational courses) via making effective use of existing infrastructure facilities and human resources.

It is mandatory to comply with all the essential requirements as given in APH 2024-27 (Chapter-VI)

Important Instructions

1. As per mandatory Disclosure of APH 2024-27(Annexure-18, page180) Institutions must disclose the following information submitted to Council at the Prominent location on its website.
   i. Department wise availability of Infrastructure along with approved courses and intake approved by the Council.
   ii. Faculty details: Department wise: Name& Designation of the faculty members/teaching staff along with their qualification, tenure of service in your organization, total experience, Institution should also disclose Student Faculty Ratio, Cadre Ratio.
   iii. Additionally Audited Financial Statements for last 3 Financial years.
2. Reservation Policy of the Central Government (Including EWS) / Respective State Government/ UT as the case shall be applicable to all the Programmes. The concerned State Government/ UT Admission authority shall decide Modalities of Admission.
3. The Institution offering courses earlier in the Regular Shift, First Shift, Second Shift/Part Time are now amalgamated as total intake and shall have to fulfil all facilities such as Infrastructure, Faculty and other requirements as per the norms specified in the Approval Process Handbook 2024-25 to 2027 for the Total Approved Intake.
4. In case of any differences in content in this Computer-generated Extension of Approval Letter, the content/information as approved by the **Executive Council / General Council as available on the record of AICTE shall be final and binding.**
5. All AICTE institutions are highly encouraged to get NBA/NAAC accreditation. All eligible AICTE institutions are thoroughly encouraged to participate in NIRF ranking process.
6. Deemed to be University: Institutions Deemed to be Universities (Running Technical Education Programmes), it is mandatory to have AICTE approval from the Academic Year 2018-19 in compliance of the Hon'ble Supreme Court Order dated 03-11-2017 passed in CA No.17869- 17870 /2017.
7. AICTE Approved Institutes are encouraged to utilize SWAYAM PLUS Courses up-to 40%
8. Internship is mandatory for all admitted students.
9. AICTE Approved Institutes are encouraged to make efficient use of the flagship schemes like:
   a. Parakh: Student Gap analysis portal bases services.
   b. Students Scholarship schemes like Pragati, Saksham, Swanath, ADF, etc.
   c. Course in Indian Languages.
   d. ATAL FDPs: Faculty training for Emerging areas and cutting edge Technologies.
   e. Augmenting Utilization of Research Assets (AURA).
   f. Smart India Hackathon: World's largest Open Innovation Platform.
10. AICTE gives approval to Institutions based on the norms / standards prescribed by the Council from time to time. To get permission from State Government/ Affiliating University /Board to conduct all approved intake by AICTE is the sole responsibility of the Institution.

Prof. Shyama Rath
Member Secretary

Copy to:

1. **The Director Of Technical Education**, Haryana**
2. **The Registrar**,**
   Maharshi Dayanand University, Rohtak

3. **The Principal / Director,**
GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT
20 Km Milestone, Jhajjar- Bahadurgarh Road
Vill. Kablana, Distt. Jhajjar, Haryana,
Kablana,Jhajjar,
Haryana,124104

4. **The Secretary / Chairman,**
4/12, EAST PUNJABI BAGH
NEW DELHI,WEST DELHI
Delhi,110026

5. **Guard File(AICTE)**

Note: Validity of the Course details may be verified at http://www.aicte-india.org/

** Individual Approval letter copy will not be communicated through Post/Email. However, a consolidated list of Approved Institutions(bulk) may be downloaded from the respective login id's.

This is a computer generated Statement. No signature Required

Annexure AC/5.48

Autonomous Colleges which have applied for reaccreditation six months before the end of the cycle of accreditation period, in case there is a delay in the accreditation process by the accrediting body, the delay period between two consecutive accreditations shall be condoned. Autonomous colleges that have not applied for reaccreditation six months before the end of the accreditation period should get the accreditation within one year from the end of the last accreditation cycle, failing which the autonomy automatically stands withdrawn.

8.4 In case Autonomous College fails to obtain the required accreditation Grade/score as per clauses 8.1, 8.2 and 8.3 above, the autonomy to such College stands automatically withdrawn, and no fresh admissions will be done under autonomy mode after withdrawal of autonomous status. No communication from the parent University and/or UGC will be needed in this regard. It will be the responsibility of the College to inform the parent University and UGC regarding the withdrawal of autonomy. However, for students admitted during autonomy period, such withdrawal shall take effect only after the last batch of students enrolled under autonomy passes out.

8.5 Such Colleges whose autonomy is withdrawn shall be eligible to apply for fresh autonomy on UGC portal, but not before one year from the effective date of withdrawal of autonomy.

9. MONITORING OF AUTONOMOUS COLLEGES

9.1 IQAC shall be established in the Autonomous College for regular monitoring of the College. The IQAC shall have an external Peer Team comprising of 2 or more members who shall be academicians of repute not below the rank of Professor. The report regarding the performance of the Autonomous College shall also be put on the public domain on the website of the College. The external peer review shall be conducted at least once in a year.

9.2 On its own or in case of an adverse report by the external peer team of IQAC or on receipt of any information/complaint, UGC may cause an inspection by constituting an Expert Committee for scrutiny and may revoke the autonomous status of the College after giving due opportunity of hearing to the management by way of notification and by passing a speaking order.

9.3 The Autonomous College shall, without fail, upload on its website, information regarding the courses offered by it, the fees for the courses, the details of the faculty along with qualification and unique ID, the admission procedure, the details of relevant infrastructures, research activities of the Autonomous College along with the details of Ph.D. students enrolled, if any, with the date of enrolment, topics and supervisor.

9.4 The Autonomous College shall also put on its website the constitution of various Committees/Cells as mandated in the various UGC Regulations notified from time to time. The Autonomous College shall conduct the meetings of the statutory bodies regularly and upload the minutes of the meetings on the college website.

9.5 The Autonomous College shall also upload such information on such web portals as may be specified by the Commission, from time to time.

10. MATTERS REGARDING STARTING OF NEW COURSES

10.1 An autonomous college is free to start certificate or diploma courses without prior approval of the parent University. The Autonomous College should inform the parent University about the introduction of such new courses. Approval of the concerned statutory bodies of the Autonomous College and Statutory Council(s)should be obtained, wherever required. Certificates and Diplomas shall be issued under the seal of the Autonomous College.

10.2 An autonomous college is free to start a new degree programme(s) at undergraduate and postgraduate levels with the approval of the Academic Council of the Autonomous College and concerned Statutory Council(s), wherever required, provided the nomenclature of the degree is in consonance with UGC Notification on Specification of Degrees, 2014 as amended from time to time. Such courses shall fulfill the minimum standards prescribed by the parent university/UGC/Statutory Council(s) in terms of number of hours, curricular content and standards, and the parent University shall be duly informed of such courses.

10.3 An autonomous college can start Ph.D. programme with the prior approval of the parent University. UGC Regulations for Ph.D. programmes as notified from time to time, must be adhered to by the parent University/Autonomous College.

10.4 An autonomous college may rename an existing course as per the UGC Notification on Specification of Degrees, 2014, as amended from time to time after restructuring/redesigning it with the approval of the Academic Council of the Autonomous College. The parent University

Annexure AC/5.49

प्रो. राजीव कुमार
सदस्य सचिव
Prof. Rajive Kumar
Member Secretary

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

अखिल भारतीय तकनीकी शिक्षा परिषद्
(भारत सरकार का एक सांविधिक निकाय)
शिक्षा मंत्रालय, भारत सरकार
नेल्सन मंडेला मार्ग, वसंत कुंज, नई दिल्ली–110070
दूरभाष : 011–29581399
ई–मेल : ms@aicte-india.org

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION
(A STATUTORY BODY OF THE GOVT. OF INDIA)
Ministry of Education, Govt. of India
Nelson Mandela Marg, Vasant Kunj, New Delhi-110070
Phone : 011-29581399
E-mail : ms@aicte-india.org

File No. AICTE/P&AP/APH/2023-24/01

24.08.2023

CIRCULAR

To,

All Vice Chancellors of Technical Education and
All Directors/ Principals of AICTE Approved Institutions,

Subject: - Guidelines for running B.E/B.Tech Program for Working Professionals in AICTE Approved Institutions.

Madam/Sir,

AICTE Approved Institutes are eligible to run B.E/B.Tech Program/Courses from the A/Y 2023-24 for working Professionals ONLY in the approved disciplines/courses having NBA Accreditation.

As per the Provisions of the Public Notice issued by AICTE vide No. AICTE/RB/Academic/2023-24 dated 24th July, 2023. The following guidelines are applicable to run the courses for Working Professionals: -

01	**Courses & Intake**	
i.	Permitted Courses	AICTE Approved Courses with NBA Accreditation.
ii.	Number of Courses	Maximum Three Courses per Institute
iii.	Permitted Intake per Course	30(Over and above the sanctioned intake)
iv.	Minimum Admission Required to Run the Course	1/3 of the Approved Intake in each course
02.	**Eligibility for Admission**	
i.	Professionals working in Registered Industry / Organization (Central / State) / Private/ Public Limited Company/ MSMEs located within 50 Km radial distance from the Institute.	
ii.	Minimum of ONE Year Full time / Regular working Experience	
iii.	Qualification Same as candidates eligible for Lateral Entry to Second Year (As Specified in Approval Process Handbook published by AICTE from time to time)	
03.	**Duration of the Course**	

i.	Same as Lateral Entry to Second Year with a total course duration NOT less than THREE years, so as to fulfill the total contact hours as prescribed by the Affiliating University for completion of duration of the course.
ii.	Timings for conduct of classes normally shall be in the evening hours/any flexible convenient timings(including weekends/holidays) in alignment with timings of Industry / Organization.
iii.	Mode of Conduct of Classes shall be as applicable for Regular Programs as defined in the AICTE Public Notice Vide. No. AICTE/AB/Academic/2020-21, dated 13th August, 2020
04.	**Academic Requirements**
i.	Total Credits as specified in the AICTE Model Curriculum (or) Affiliating University are required to be earned for getting the Degree.
ii.	As per the AICTE Regulation up to 40% of credit transfer is permitted through MOOCs / SWAYAM.
05.	**Faculty & Staff Requirement**
i.	As per the prevailing AICTE Norms (or) Existing Faculty in the Institute / Industry Experts with requisite qualification as per AICTE Norms are permitted with additional remuneration / honorarium as per the Affiliating University / State Government / Institute Norms.
ii	Existing staff (Technical / Supporting) are permitted with additional remuneration / honorarium as per the Affiliating University / State Government Norms.
06.	**Infrastructure Requirements**
	Existing Infrastructure can be used
07.	**Mode of Admission or Admission Policy**
i.	As per the University /State Admission Policy. In absence of any such Admission Policy in respect of working professionals, institute can devise transparent mechanism for short listing the eligible candidates in highly transparent manner based on Merit of the Qualifying Examination.
ii	Reservation Policy of the respective State/UT is applicable.
08.	**State Government/ University Requirements**
	Universities shall affiliate the Working Professionals admitted in AICTE Approved Institutes for B.E / B.Tech Courses under this Policy in regular mode.
09.	**Other Requirements**
	AICTE Approved Institutes shall fulfill any other requirements as specified / required which are notified from time to time.

Your Sincerely,

24.8.23

(Prof. Rajive Kumar)
Member Secretary

9

प्रो. राजीव कुमार
सदस्य सचिव
Prof. Rajive Kumar
Member Secretary

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

अखिल भारतीय तकनीकी शिक्षा परिषद्
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Ministry of Education, Govt. of India
Nelson Mandela Marg, Vasant Kunj, New Delhi-110070
Phone : 011-29581399
E-mail : ms@aicte-india.org

AICTE/RB/Misc./2023-24 **Dated:21.03.2024**

Circular

To,

All Vice Chancellors of Technical Education and All Directors/
All Directors of State Technical Boards
Principals of AICTE approved Institutions/All Principals of Polytechics.

Sub: Revised guidelines for running working professionals (Diploma /UG/PG) in AICTE approved institutions for A.Y. 2023-24-reg.

Sir,

In continuation to letter no. AICTE/P&AP/APH/2023-24/02 dated 24.08.2023 regarding guidelines for running Diploma Program for working Professionals in AICTE approved Institutions and letter no. AICTE/P&AP/APH/2023-24/01 dated 24.08.2023.

2. In this regard, it is intimated that council has considered and approved relaxation for minimum admission (1/3rd) required to run the courses for working professionals for A.Y. 2023-24 only. The distance criteria for the eligibility of a working professionals as mentioned in the aforesaid guidelines is modified to the extent "The existing to 75 KM either from place of residence/working place to the enrolled institutions"

This is for your kind information and necessary action please.

Your sincerely,

21.3.2024

(Prof. Rajive Kumar)
Member Secretary

Copy to:

1. Principal Secretary, State Higher & Technical Education
2. VCs/Registrar of Affiliating Universities
3. DTE, State Dept. of Technical Education

10

Annexure AC/5.50

Annexure A/3

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR
AN AUTONOMOUS INSTITUTE | GRADED 'A' BY NAAC | AFFILIATED TO MDU, ROHTAK

ACADEMIC CALENDAR SESSION 2026-27

Odd Semester (1st, 3rd and 5th)

Sr. No.	Name of Activity	Proposed Dates and Months
1	Commencement of Orientation Program for students of 1st Semester	From 10.08.2026 to 24.08.2026
2	Starting of Classes / Academic Session (for 1st, 3rd and 5th Semester)	From 25.08.2026
3	Teaching Period	From 25.08.2026 to 19.12.2026
4	Conduct of 1st Sessional Test	30.10.2026 to 03.11.2026
5	Conduct of 2nd to Sessional Test	16.12.2026 to 19.12.2026
6	Conduct of 3rd to Sessional Test (Optional)	23.12.2026 to 26.12.2026
7	External Practical Exams	28.12.2026 to 31.12.2026
8	Final End Semester Examinations	01.01.2027 onwards (Tentative)

Even Semester (2nd, 4th and 6th)

Sr. No.	Name of Activity	Proposed Dates and Months
1	Starting of Classes / Academic Session (for 2nd, 4th and 6th Semester)	From 25.01.2027
2	Teaching Period	From 25.1.2027 to 22.05.2027
3	Conduct of 1st Sessional Test	24.03.2027 to 27.03.2027
4	Conduct of 2nd to Sessional Test	15.05.2027 to 19.05.2027
5	Conduct of 3rd to Sessional Test(Optional)	24.05.2027 to 26.05.2027
6	External Practical Exams	27.05.2027 to 31.05.2027
7	Final End Semester Examinations	01.06.2027 onwards (Tentative)

Note:

1. The next academic session i.e. 2027-28 will start from 01.07.2027.
2. If the number of teaching days falls less than 180 days (90 days in each semester) in all programs due to unforeseen reasons, it would be the responsibility of the Head of the concerned Department to make good the loss by arranging extra classes.

Registrar

(11)

Annexure AC/5.51

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA
AN AUTONOMOUS INSTITUTE | GRADED 'A' BY NAAC | AFFILIATED TO MDU ROHTAK

EXAMINATIONS

Ref. No.: Exam/2026/022 Date: 17/07/2026

To
The Director
GITAM,

Subject: Request for approval of Panel of Examiners submitted by various Boards of Studies for placing before the Academic Council

Respected Sir,

With reference to the recommendations received from the Chairpersons of various Boards of Studies (BOS) of the Institute regarding the panel of examiners for Theory/ Practical Examination, it is submitted that the respective Boards of Studies have considered and approved the panels of examiners department-wise.

The approved panels received from the concerned Departments/Boards of Studies are enclosed herewith as **Annexure-I** for your kind perusal and approval.

It is requested that the matter may kindly be considered and the proposed panel of examiners may please be approved for placing before the forthcoming meeting of the Academic Council for its approval, as per the provisions of the Institute.

Submitted for your kind consideration and necessary approval, please.

Yours faithfully,

Controller of Examinations
Ganga Institute of Technology and Management
Jhajjar (Haryana)

Approved

Enclosure: Annexure-I – Department-wise panel of examiners approved by the respective Boards of Studies.

~~Annexure 4.7~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

(An Autonomous Institute under Maharshi Dayanand University, Rohtak and Accredited with NAAC'A' Grade)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PANEL OF EXAMINERS FOR THEORY, PRACTICAL / DISSERTATION / PROJECT / SEMINAR

Sr. No	Name of Examiner	Affiliation / Organization	Designation	Contact no.	Email id
1	Professor Rajiv Kapoor	DTU, Delhi	Professor	9999432549	rajivkapoor@dce.ac.in
2	Professor Manoj Duhan	DCRUST, Murthal, Sonepat	Professor	9355628366	manojduhan.ece@dcrustm.org
3	Professor Manoj Taleja	NIT, Delhi	Professor	9873853870	manojtaleja@nitdelhi.ac.in
4	Professor Vijay Nehra	BPSMV, Khanpur, Kalan	Professor	9255229683, 9255229582	nehra_vijay@yahoo.com
5	Professor Amit Garg	DCRUST, Murthal, Sonepat	Professor	8901124120	amitgarg.ece@dcrustm.org
6	Professor Sandeep Arya	GJU, Hissar	Professor	9416397567	sandeeparya@gjust.org
7	Professor Deepak Kedia	GJU, Hissar	Professor	9315435151	kediadeepak@gjust.org
8	Professor Pardeep Sangwan	MSIT, Janakpuri Delhi	Professor	9999026516	sangwanpardeep@gmail.com
9	Professor Sunil Mathur	MAIT, Rohini, Delhi	Professor	9868488513	sunilkumar@mait.ac.in
10	Professor Rajiv Sharma	BPIT, Rohini, Delhi	Professor	9896013226	hodece@bpitindia.com
11	Professor Kirtee	BVP, Delhi	Professor	9891349346	kirti.gupta@bharatividyapeeth.edu
12	Dr. Anil Dudy	Baba Mast Nath University, Rohtak	Professor	9466907292	anildudy10@gmail.com
13	Professor Jasdeep Kaur	IGTUW, Delhi	Professor	9968485100	jasdeep@igdtuw.ac.in
14	Professor Neeta Pandey	DTU, Delhi	Professor	9868780900	neetapandey@dce.ac.in
15	Dr. Rajiv Dahiya	NIILM University, Kaithal	Professor	8168132035	rajivdahiya2@gmail.com
16	Dr. Vikram	MVDTU, J&K	Associate Professor	9466754797, 7006635863	vikram.singh@smvdu.ac.in, vikram.jangra@gmail.com
17	Dr. Dileep	IP, University, Delhi	Assistant Professor	9582388064	dileep.gcet@gmail.com
18	Professor Amit Prakash	IP, University, Delhi	Professor	9899166168	amit@ipu.ac.in
19	Dr. Arti Jain	NSUT, Delhi	Assistant Professor	9871588459	aarti.jain@nsut.ac.in
20	Dr. Vikas Nandal	UIET, MDU Rohtak	Associate Professor	9812006446	nandalvikas@gmail.com
21	Dr. Anil Sangwan	UIET, MDU Rohtak	Associate Professor	8168332820, 9466444460	sangwan_anil2002@yahoo.com

22	Dr. Vikas Sindhu	UIET, MDU Rohtak	Associate Professor	9466312377	sindhuvikas@yahoo.com
23	Dr. Shamsher Singh	UIET, MDU Rohtak	Professor	9416659496	samsher.uiet@gmail.com
24	Dr. Manoj Kumar	UIET, MDU Rohtak	Associate Professor	9416546180	ahlawat.manoj@gmail.com
25	Professor Rakesh Kumar Joon	GITAM, Kablana	Professor	9813972062	rakesh.ece@gangainstitute.com
26	Dr. Vivek Kumar	GITAM, Kablana	Professor	9812390916	vivek.ece@gangainstitute.com
27	Dr. Hitanshu Saluja	GITAM, Kablana	Professor	9050272255	hitanshu.ece@gangainstitute.com
28	Dr. Nitin Kumar	GITAM, Kablana	Professor	9466887689	nitin.ece@gangainstitute.com
29	Dr. Sumit Sangwan	FCEM, Faridabad	Professor	9416759324	sangwan.sumit2005@gmail.com
30	Dr. Ramendra	RKGIT, Ghaziabad, UP	Professor	9958691699, 9310878197	singh.ramendra23@gmail.com
31	Dr. Parveen Malik	LPU, Jalandhar, Punjab	Associate Professor	9719437711	praveen.23314@lpu.co.in
32	Ms. Sonia Arora	GITAM, Kablana	Assistant Professor	9416370400	sonia.ece@gangainstitute.com
33	Ms. Ritu Devi	GITAM, Kablana	Assistant Professor	8059844235	ritubeniwal.ece@gangainstitute.com
34	Dr. Sandeep Dahiya	BPSMV, Khanpur, Kalan	Associate Professor	9416776660	sandy_dahiya2001@yahoo.com
35	Mr. Sachin Dahiya	CRS College of Engg and Technology, Jhajjar	Assistant Professor	9812135955	sachindahiya@rediffmail.com
36	Dr. Abhimanyu Nain	GJUST Hisar	Assistant Professor	9728073877	abhimanyu.nain@gjust.org
37	Dr. Meenu Manchanda	VCE Rohtak	Professor	9416767399	meenumanchanda73@gmail.com
38	Mr. Amit Dalal	GITAM KABLANA	Assistant Professor	9813789833	amit.ece@gangainstitute.com
39	Mr. Satish	GITAM KABLANA	Assistant Professor	9728271708	satish.ece@gangainstitute.com
40	Ms. Lalina Devi	GITAM KABLANA	Assistant Professor	9953540103	lalina.ece@gangainstitute.com
41	Ms. Gagan Preet Kaur	GITAM KABLANA	Assistant Professor	8059097319	gaganpreet.ece@gangainstitute.com
42	Mrs. Ritu Juneja	GITAM KABLANA	Assistant Professor	9034881010	ritu.ece@gangainstitute.com
43	Mr. Vishal	GITAM KABLANA	Assistant Professor	8684846668	vishal.ece@gangainstitute.com
44	Dr. Jitender Khurana	Gurugram University, Gurugram (Hr.)	SDO	9896030910	drjitenderkhurana@gmail.com
45	Dr. Anubha Goel	MAIT, Rohini, Delhi	Assistant Professor	9968058820	anubhagoel15@gmail.com
46	Dr. Neeraj	MAIT, Rohini, Delhi	Assistant Professor	7011820490	neerajrathee@mait.ac.in

47	Dr. Amit Saxena	MAIT, Rohini, Delhi	Assistant Professor	8527569261	amitelectrobond@gmail.com
48	Dr. Rishu Bhatia	Jagannath Community College, Sec-3 , Rohini, Delhi	Professor	9813939292	rishu.bhatia@jimsindia.org
49	Dr. Anamika Jain	MAIT, Rohini, Delhi	Assistant Professor	9599215293	anamikajain9@gmail.com
50	Mr. Dheeraj Kapoor	VCE Rohtak	Assistant Professor	9354560775	kapoordhiraj79@gmail.com
51	Dr. Umesh Gupta	MERI Sampla	Professor	9896233861	directormericet@gmail.com
52	Dr. Rohit Anand	G B Pant Govt Engg College New Delhi	Assistant Professor	9416281993	anand.rohit2011@gmail.com
53	Dr Kamal Sardana	TITS, Bhiwani	Associate professor	9466009988	saedanakamal@yahoo.com
54	Dr. Kuldeep	BRCM College of Engg. & tech. Bahal Bhiwani	Assistant Professor	8708105447	kuldeepsharma@brcm.edu.in
55	Dr. Amardeep	VCE Rohtak	Assistant Professor	7206248109	amardeep22@gmail.com
56	Dr. Sonam Rewari	DTU, Delhi	Assistant Professor	9953603644	rewarisonam@gmail.com
57	Dr. Deepak Dhadwal	Chandigarh Engineering College	Associate professor	9818161442	deepakdhadwal.007@gmail.com
58	Dr. Aditi Sharma	IITM, Bahadurgarh, Haryana	Associate professor	8284037133	kalsh.aditi@gmail.com
59	Dr. Akansha Kulshreshtha	DPG, Degree College, Gurugram	Associate professor	7982949291	akansha.kulshreshtha@dpgdegree college.com
60	Dr. Rajiv Dahiya	Neelam University, Kaithal	Professor	8168132035	rajivdahiya2@gmail.com
61	Dr. Sanjay Kmar	School of Aeronautics, Neemrana	Professor	8076421213	sanjayanu16@rediffmail.com
62	Dr. Sonu Rana	DPGITM, Gurugram	Associate professor	9416903736	sonu.rana1980@gmail.com

Note: For Dissertation / Project (PG) Examination Faculty should posses minimum Ph.D. Degree or not below the rank of Associate Professor. In case of non availability of examiners from above said list, Director of the institute can nominate the eligible expert on his discretion. In addition to the above faculties from institute of National Importance / Eminence viz. IIT's, NIT's, IIIT's, State or Central University and industry personal not below the Manager rank are also eligible with the permission of Director of the Institute.

Annexure 4.7

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

(An Autonomous Institute under Maharshi Dayanand University, Rohtak and Accredited with NAAC 'A' Grade)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Panel of Examiners for Theory, Practical/Dissertation/Project/Seminar Examinations of B.Tech. (CSE, AIML, and DS) and M.Tech. (CSE and CFIS) Programmes for the Academic Session 2026–2027

Sr. No	Name of Examiner	Designation	Affiliation / Organization	Contact No.	Email id
1	Dr. Yudhvir Singh	Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9315517965	dr.yudhvirs@gmail.com
2	Dr. Rahul Rishi	Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9812175085	rahulrishi@rediffmail.com
3	Dr. Nasib Singh Gill	Professor	Department of Computer Science & Application, MDU, Rohtak	9050805136	nasib.gill@mdurohtak.ac.in
4	Dr. Yogesh Chhaba	Professor	Department of Computer Science & Engineering, Guru Jambeshwar University Science & Technology, Hisar	9416080020	yogeshchaba@yahoo.com
5	Dr. Ashutosh Dixit	Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9873356911	dixit.ashutosh@jcboseust.ac.in
6	Dr. V. P. Vishwakarma	Professor	University School of Information, Communication & Technology, GGSIPU, Dwarka, New Delhi	9891307464	virendravishwa@gmail.com
7	Dr. Amit Prakash Singh	Professor	University School of Information, Communication & Technology, GGSIPU, Dwarka, New Delhi	9899166168	amit@ipu.ac.in
8	Dr. Namita Gupta	Professor	Department of Computer Science & Engineering, Maharaja, Agrasen Institute of Technology (MAIT), Rohini, Delhi	9811257754	namita@mait.ac.in
9	Dr. Parvinder Singh	Professor	Department of Computer Science & Engineering, DCRUST, Murthal, Sonipat	9416108322	parvindersingh.cse@dcrustm.org
10	Dr. Dinesh Singh	Professor	Department of Computer Science & Engineering, DCRUST, Murthal, Sonipat	9466368273	dineshsingh.cse@dcrustm.org
11	Dr. Manoj Kumar	Professor	Department of Computer Science & Engineering, DTU, Delhi	9013057758	mkumarg@dce.ac.in
12	Dr. Vinod Kumar	Professor	Department of Computer Science & Engineering, DTU, Delhi	9811605325	vinod_k@dtu.ac.in
13	Dr. R. K. Agrawal	Professor	School of Computer & Systems Sciences, JNU, New Delhi	09810115033	rka@mail.jnu.ac.in
14	Dr. Shailender Verma	Professor	Department of Computer Science & Engineering, DTU, Delhi	9810566485	shailenderkumar@dce.ac.in
15	Dr. Gopal Singh	Associate Professor	Department of Computer Science & Application, MDU, Rohtak	9896882065	gsbhoria.dcsa@mdurohtak.ac.in

16	Dr. Jyoti	Associate Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9910341139	jyotiverma@jcboseust.ac.in
17	Dr. Vikas Siwach	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416630655	singhvikashuiet@gmail.com
18	Dr. Harkesh Sehrawat	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416486828	sehrawat_harkesh@mduroht ak.ac.in
19	Dr. Kamna Solanki	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	8053419626	kamna.mduro htak@gmail.c om
20	Dr. Preeti Gulia	Associate Professor	Department of Computer Science & Application, MDU, Rohtak	9467485548	preeti@mduro htak.ac.in
21	Dr. Pramod	Associate Professor	Department of Computer Science & Engineering, GITAM, Kablana	7419110008	parmod.cse@g angainstitute.c om
22	Dr. Sanjeev Indora	Associate Professor	Department of Computer Science & Engineering, DCRUST, Murthal	9466256121	sanjeevindora. cse@dcrustm. org
23	Dr. Kamaldeep	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416952504	kamalmintwal @gmail.com
24	Dr. Yogesh Kumar	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9050607001	Yogs_crsce@ yahoo.com
25	Dr. Bal Kishan	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9416517453	balkishan@m durohtak.ac.in
26	Dr. Sunita Dhingra	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9255100092	sunitadhingra mdu@rediff.c om
27	Dr. Pooja Mittal	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9468110000	pooja@mduro htak.ac.in
28	Dr. Priti Sharma	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	8708395855	priti@mduroht ak.ac.in
29	Dr. Karan Singh	Assistant Professor	School of Computer & Systems Sciences, JNU, New Delhi	9971037951	karan@mail.jn u.ac.in
30	Dr. Karan Verma	Assistant Professor	Department of Computer Science & Engineering, NIT Delhi		karanverma@ nitdelhi.ac.in.
31	Dr. Manisha Manjul	Assistant Professor	Department of Computer Science & Engineering, G.B. Pant Govt. Engineering College (DSEU), New Delhi	8826367541	manisha.manj ul@dseu.ac.in
32	Dr. Harish Kumar	Assistant Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9911911782	htanwar@jcbo seust.ac.in
33	Dr. Neeetu Verma	Assistant Professor	Department of Computer Science & Engineering, DCRUST, Murthal	8708445914	neetuverma.cs e@dcrustm.or g
34	Dr. Dheer Dhwaj Barak	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9315809071	dheer.rp.uiet@ mdurohtak.ac.i n
35	Dr. Priyanka Rani	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	7988501899	priyachhillar3 0@gmail.com
36	Dr. Divya	Assistant Professor	Vivekananda Institute of Professional Studies-Technical Campus, GGSIPU, Delhi	9968362010	er.divya7@gm ail.com

37	Dr. Sudesh Yadav	Assistant Professor	Department of Computer Science & Engineering, Govt. PG College Ateli	6467652778	yadavsudesh01@gmail.com
38	Dr. Shweta Rani	Assistant Professor	Department of Computer Science & Engineering, Jaypee Institute of Information Technology (JIIT), Noida	7838423088	shweta.rani@jiit.ac.in
39	Mr. Rahul	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	8059413612	rahul.cse@gangainstitute.com
40	Ms. Upasna	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	8295200669	upasna.cse@gangainstitute.com
41	Mr. Jitender Kumar	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	9996439970	jsaini.ymca@gmail.com
42	Mr. Dheeraj Kumar Sahni	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9034882111	dheerajsahni91@gmail.com
43	Dr. Dheer Dhwaj Barak	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9315809071	dheer.rp.uiet@mdurohtak.ac.in
44	Ms. Ritu Kadyan	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	7065217140	ritukadyan.cse@gangainstitute.com
45	Ms. Nisha	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	8059175375	nisha.cse@gangainstitute.com
46	Mr. Jitender Singh	Assistant Professor	Department of Computer Science &Applications, GITAM, Kablana	9891599903	hod.ca@gangainstitute.com
47	Ms. Meenu Sharma	Assistant Professor	Department of Computer Science &Applications, GITAM, Kablana	9050237645	minu.cse@gangainstitute.com
48	Dr. Pankaj Lathar	Director	Delhi Skill and Entrepreneurship University, New Delhi	9891640788	pankaj.lathar@desu.ac.in
49	Dr. Yogesh Kumar	Associate Professor	Department of Computer Science & Engineering, GD Goenka University, Gurugram	9466973730	yogesh.kumar1@gdgu.org
50	Dr. Vinod Kumar Saroha	Associate Professor	Department of Computer Science & Engineering, Bhagat Phool Singh Mahila Viswavidyalaya, Khanpur Kalan, Sonipat	9416427656	vinod.saroha@bpswomenuniversity.ac.in
51	Dr. Anil	Professor	Department of Computer Science & Application, GITAM, Kablana	9466350772	hod.ca@gangaistitute.com
52	Dr. Sandeep Sharma	Associate Professor	HOD-AIML/DS, St. Andrew Institute of Technology and Management, Farukhnagar	9896694979	hod.aiml@saitm.ac.in
53	Mikanshu Rani	Assistant Professor	Department of Emerging Technology, Chandigarh Engineering College, CGC-Landran	9467346259	Mikanshu6406@gmail.com
54	Dr. Neebu Gupta	Professor	Chandigarh University	9050272255	Menu.e9406@cumail.in
55	Dr. Nishant Anand	Associate Professor	IMS Engineering College Ghaziabad	9812273967	drnishantanand@gmail.com
56	Dr. Sandhya Tarwana	Assistant Professor	Vivekananda Institute of Professional Studies-Technical Campus, GGSIPU, Delhi		sandhya Tarwani@vips.edu

57	Dr. Sonakshi Vij	Assistant Professor	Vivekananda Institute of Professional Studies-Technical Campus, GGSIPU, Delhi		Sonakshi.vij@vips.edu

Note: For Dissertation / Project (PG) Examination Faculty should posses minimum Ph.D. Degree or not below the rank of Associate Professor. In case of non availability of examiners from above said list, Director of the institute can nominate the expert on his discretion. In addition to the above faculties from institute of National Importance / Eminence viz. IIT's, NIT's, IIIT's, State or Central University and industry personal not below the Manager rank are also eligible with the permission of Director of the Institute.

~~Annexure 4.7~~

DEPARTMENT OF CIVIL ENGINEERING

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

(An Autonomous Institute under Maharshi Dayanand University, Rohtak and Accredited with NAAC'A' Grade)

Panel of Theory Paper Setter and Practical Examiners for B.Tech (CE) and M. Tech (SD)

Sr. no	Name	Affiliation / Organization	Designation	Contact no.	Email id
1	Ms. Sheela Malik	GITAM Kablana	HOD, CIVIL	9896275296	sheela.civil@gangainstitute.com
2	Dr. Mahesh Pal	NIT , Kurukshetra	Professor	9416236932	Mahesh.pal@nitkkr.ac.in
3	Dr. Pankaj Munjal	NIT , Kurukshetra	Asst. Prof.	9213860000	Pankajmunjal@nitkkr.ac.in
4	Dr. J.S. Yadav	NIT , Kurukshetra	Asst. Prof.	9653787165	jsyadav@nitkkr.ac.in
5	Dr. Harish Panghal	Universidad De Chile	PDF	8607269883	Harishpanghal2012@gmail.com
6	Dr. Anant Lal Murmu	NSUT, Delhi	Asst. Prof.	9601936215	anant.lal.murmu@nsut.ac.in
7	Dr. Deepak Kumar Verma,	UIET, MDU, Rohtak	Asst. Prof.	8059385333	drdeepakverma.uiet@mdurohtak.ac.in
8	Dr. Anu Bala,	UIET, MDU, Rohtak	Asst. Prof.	9416959991	er.jangraanu@gmail.com
9	Dr. Isha Verma	UIET, MDU, Rohtak	Asst. Prof.	9812188155	isha.1272@gmail.com
10	Mr. Vineet	UIET, MDU, Rohtak	Asst. Prof.	9812373733	vineet.uiet@mdurohtak.ac.in
11	Dr. Vikas Garg	CUH, Mahendargarh	Professor	9690757370	gargvikas27@cuh.ac.in
12	Dr. Neeraj Kumar	CUH, Mahendargarh	Professor	8708477312	neerajlohchab@cuh.ac.in
13	Dr. Bhaskar Das	CUH, Mahendargarh	Professor	8489973850	bhaskardas@cuh.ac.in
14	Er. Saurabh Jaglan	DCRUST, Murthal	Asst. Prof.	8901279918	mast.jaglan@gmail.com
15	Er. Arti Chouksey	DCRUST, Murthal	Asst. Prof.	9729225496	arti.civil@dcrustm.org
16	Er. Sunita	DCRUST, Murthal	Asst. Prof.	9467166328	Sunitakumari.civil@dcrustm.org
17	Dr.Ghanshyam	Aryabhat Institute of Technology	Asst. Prof.	9899561646	drgsb2016@gmail.com
18	Dr. Ravish Rathee	UIET, MDU, Rohtak	Asst. Prof.	9466308007	ravishrathee.rp.uiet@mdu.ac.in
19	Mr. Manjeet	UIET, MDU, Rohtak	Asst. Prof.	9588332199	manjeet.rp.uiet@mdu.ac.in
20	Mr.Amit Kumar,	UIET, MDU, Rohtak	Asst. Prof.	9416809418	amitloura33@gmail.com

21	Mr. Vishwas	UIET, MDU, Rohtak	Asst. Prof.	9812076810	vishwasmalik.rp.uiet@mdurohtak.ac.in
22	Dr. S.K Singh	Delhi Technological University Delhi	Professor	9891599903	sksingh@dce.ac.in
23	Dr. Ashutosh Trivedi	Delhi Technological University Delhi	Professor	9050237645	atrivedi@dce.ac.in
24	Ms. Sonal Bhugra	Manav Rachna University, Faridabad	Asst. Prof.	09810814457	sonalbhugra@gmail.com
25	Dr. Srijit Biswas	Manav Rachna University, Faridabad	Asst. Prof.	08826454764	srijitbiswas@yahoo.com
26	Ms. Anjali Gupta	Manav Rachna University, Faridabad	Asst. Prof.	8800613338	catchanjali@yahoo.co.in
27	Ms. Nitu	Maturam Institute of Engineering and Technology, Rohtak	Asst. Prof.	9050001456	nbalhara884@gmail.com
28	Mr. Shiv	SKITM	Asst. Prof.	9953403233	Er.shiv2012@gmail.com
29	Mr. Pankaj Dahiya	Ch. Ranbir Singh Institute of Engineering and Technology, Jhajjar	Asst. Prof.	8222888865	dahiya.pankaj533@gmail.com
30	Dr. Sandeep Malik	Ch. Ranbir Singh Institute of Engineering and Technology, Jhajjar	Asst. Prof.	9034534933	maliksandeepce@gmail.com
31	Ms. Suvidha	Ch. Ranbir Singh Institute of Engineering and Technology, Jhajjar	Asst. Prof.	9991719258	
32	Dr. Sagar Paruthi	KR Mangalam University, Gurugram	Asst. Prof.	9996089811	head.ced@dpgitm.ac.in
33	Ms. Anju	GITAM Kablana	Asst. Prof.	90347008030	anju.civil@gangainstitute.com
34	Mr. Bhupinder Malik	GITAM Kablana	Asst. Prof.	8950009798	bhupi344@gmail.com
35	Mr. Mukesh	GITAM Kablana	Asst. Prof.	9050237646	Mukesh.ce@gangatechnicalcampus.com
36	Mr. Prince	GITAM Kablana	Asst. Prof.	8708655157	Prince.civil@gangainstitute.com
37	Mr. Abhishek Ojha	GITAM Kablana	Asst. Prof.	7566991680	abhishek22dec@gmail.com

Note: For Dissertation / Project (PG) Examination Faculty should possess minimum Ph.D. Degree or not below the rank of Associate Professor. In case of non-availability of examiners from above said list, Director of the institute can nominate the expert on his discretion. In addition to the above faculties from institute of National Importance / Eminence viz. IIT's, NIT's, IIIT's, State or Central University and industry personal not below the Manager rank are also eligible with the permission of Director of the Institute.

Chairperson
Board of Studies
Civil Engineering Deptt

ANNEXURE-4.8

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

(An Autonomous Institute under Maharshi Dayanand University, Rohtak and Accredited with NAAC 'A' Grade)

DEPARTMENT OF ELECTRICAL ENGINEERING

Panel of Theory Paper Setter and Practical Examiners for B.Tech (EE) and M. Tech (EPS)

Sr. no	Name	Affiliation / Organization	Designation	Contact no.	Email id
1	Dr. A P Mittal	NSUT Delhi	Adjunct Professor	9899249107	mittalap@gmail.com
2	Dr. Mukhtiar Singh	DTU Delhi	Professor	8901073179	mukhtiarsingh@dce.ac.in
3	Prof. R K Ahuja	YMCA Faridabad	Professor	09990477433	rajeshkrahuja@gmail.com
4	Prof. Sathans	NIT, Kurukshetra	Professor	9416334934	sathans@nitkkr.ac.in
5	Prof. J S Lathar	NIT, Kurukshetra	Professor	9467500101	jslather@nitkkr.ac.in
6	Prof. Rakesh Ranjan	Sushant University, Gurugram	Professor	9996787090	ranjan66@yahoo.com
7	Prof. Rajesh Kumar	MNIT, Jaipur	Professor	9549654481	rkumar.ee@mnit.ac.in
8	Prof. Ajay Kumar Bansal	CUH, Mahendergarh	Professor	9414253620	ajaybansal@cuh.ac.in
9	Dr. Prerna Gaur	NSUT Delhi	Professor		prernagaur@yahoo.com
10	Dr. Naresh Yadav	DCRUST, MURTHAL	Professor	9466176565	nareshyadav.ee@dcrustm.org
11	Dr. Surender Dahiya	DCRUST, MURTHAL	Professor	9416294032	surenderdahiya.ee@dcrustm.org
12	Dr. Sanju Saini	DCRUST Murthal	Professor	9416664323	Sanjusaini.ee@dcrustm.org
13	Dr. Ankit Bansal	VCE Rohtak	Professor.	9416291163	ankitbansal1210@gmail.com
14	Dr. Vaibhav Jain	VCE, Rohtak	Professor	7015719857	Vaibhav.apr3004@gmail.com
15	Dr Joginder Singh	GITAM Kablana	Professor	9654292946	jogiparas@gmail.com
16	Dr. Vipin Kumar	UIET, MDU	Asst. Prof.	8222880106	drvipin.uiet@mdurohtak.ac.in
17	Dr. Neha Khurana	UIET, MDU	Asst. Prof.	9416996545	nehakhurana.uiet@mdurohtak.ac.in
18	Dr. Surender Singh	UIET, MDU	Asst. Prof.	8295088199	surender.uiet@mdurohtak.ac.in
19	Dr. Meena	UIET, MDU	Asst. Prof.	8814846900	meena.uiet@mdu.ac.in
20	Dr. Gurdiyal Singh	UIET, MDU	Asst. Prof.	9996644747	gsuiet@mdurohtak.ac.in
21	Dr. Anil Kumar	DCRUST, MURTHAL	Asst. Prof.	9467009907	anil.ee@dcrustm.org
22	Dr. Manish Kumar	DCRUST Murthal	Associate Professor	8950187993	manishkumar.ee@dcrustm.org
23	Dr. Deepesh Sharma	DCRUST Murthal	Asst. Prof.	9812840554	deepeshsharma.ee@dcrustm.org

24	Dr Muralidhar Nayak Bhukya	CUH, Mahendergarh	Asst. Prof.	9550944396	Murlidhar.nayak@cuh.ac.in
25	Dr Sumit Saini	CUH, Mahendergarh	Asst. Prof.	9416121343	drsumiteed@cuh.ac.in
26	Dr. Bhupender Sharma	ABES Engineering College, UP	Associate Prof.	9896334771	bhupender638@gmail.com
27	Dr. Muralidhar Killi	NIT Kurukshetra	Assistant Prof.	9778463355	muralidhar.killi@nitkkr.ac.in
28	Dr. Priyanka,	BPS, Khanpur.	Asst. Prof.	9996551112	anand_priyanka10@yahoo.co.in
29	Dr. Samshad,	Mewat Engineering College Nuh.	Asst. Prof.	9718184339	samshad.jmi@gmail.com
30	Dr Puneet Chawala	Ch. Devilal State Institute of Engg.P.Mota, Sirsa	Asst. Prof.	9416788602	puneet1817@gmail.com
31	Dr Naveen Kumar	GITAM Kablana	Asst. Prof.	9034897967	Naveenkaushik.ee@gangainstitute.com
32	Mr Abhishake Jain	GITAM Kablana	Asst. Prof.	8368869243	abhishake.ee@gangainstitute.com
33	Dr. Garima Tiwari	GITAM Kablana	Asst. Prof.	7838744929	garima.ee@gangainstitute.com
34	Dr. Minaxi	RPS Mahendragarh	Asst. Prof.	9466119424	minaxichalia@gmail.com
35	Dr. Sombir Kundu	MMU Mulana	Asst. Prof.	9991586513	sskundu46@gamil.com
36	Mr. Deshveer	GITAM KAblana	Asst. Prof.	9728670502	deshveer.ee@gangainstitute.com
37	Dr. Harish Kumar	CRSSIET Jhajjar	Asst. Prof.	9891714567	harishkhola@gmail.com
38	Dr. Vivek Kumar	BRCM,Bahal,Bhiwani	Asst. Prof.	9992261561	pevivek@gmail.com
39	Dr G.H. Reddy	DPGITM Gurgaon	Asst. Prof.	9704638836	ghkr220@gmail.com
40	Dr Manjeet Sharma	KVMT Siwani	Asst. Prof.	9416247919	kvmtengineering@gmail.com
41	Mr. Parveen Saini	VCE, Rohtak	Asst. Prof.	9467457362	parveensainirtk@gmail.com
42	Mrs Kavita Bansal	UIET, MDU	Asst. Prof.	8684065063	kavitabansal.rp.uiet@mdurohtak.ac.in
43	Ms Pinky Sheoran	UIET, MDU	Asst. Prof.	9466009728	pinkey.rp.uiet@mdurohtak.ac.in
44	Mr Sumit Mor	UIET, MDU	Asst. Prof.	8814882111	sumitmor.rp.uiet@mdurohtrak.ac.in

Note: For Dissertation / Project (PG) Examination, the faculty should possess minimum Ph.D. Degree or not below the rank of Associate Professor. In case of non-availability of examiners from the above-mentioned list, the Director of the institute can nominate the expert on his discretion. In addition to the above faculties from the Institute of National Importance / Eminence viz. IIT's, NIT's, IIIT's, State or Central University and industry personnel not below the Manager rank are also eligible with the permission of Director of the Institute.

Annexure 4.7

DEPARTMENT OF FIRE TECHNOLOGY AND SAFETY
GANGA INSTITUTE OF TECHNOLOY AND MANAGEMENT, KABLANA, JHAJJAR
AN AUTONOMOUS INSTITUTE | GRADED 'A' BY NAAC

Panel of Examiners

Fire and Safety Domain Courses

1. Sh. R. C. Sharma, Director (Retd.) Delhi Fire Service, Professor of Practice, IP University, Delhi rcsharmadfs@gmail.com, 9868040509
2. Dr. Amir Ali Khan, Professor, National Institute of Disaster Management, Rohini, Delhi amir.nidm@nic.in, 7840847473
3. Dr. A.R. Sontake, Professor, NFSC, Nagpur, arsontake@gmail.com, 9407981871
4. Sh. Devender Gill, Executive Director, Delhi Metro Rail Coorporation, dga232@gmail.com, 9810201878
5. Kumar Waibhav, DGM Group FLS Head, DLF Limited, kumarwaibhav07@gmail.com, 9953670101
6. Mr. Vishal Phogat, Sustainability and Compliance Manager, HP Inc., vtornadoking@gmail.com, 9568874100
7. Mr. Nitish Bhardwaj, Fire Station Officer, Haryana Fire Service, nitishfns@gmail.com, 9873727576
8. Mr. Himank Tomar, Fire and Safety Officer Bureauveritas, himank.tomar36@gmail.com, 8512818008
9. Dr. Prasandit Mandul, Associate Professor, GD Goenka University, Gurugram, 8192940767
10. Dr. B.P. Yadav, UPES Dehradun, bpyadav@ddn.upes.ac.in ,7055044111
11. Mr. Nitin, HOD Fire Engineering, MRK Institute of Engineering and Technology, Rewari, 9671492391
12. Mr. Vishal Harit, Station Officer, Delhi Fire Service, vpharit@gmail.com, 9956021048
13. Dr. Gagandeep Devgan, Fire Officer, Hotel Jaypee Sidharth, 9871988090
14. Mr. Ashish Dalal, Assistant Manager, Fire State Bank of India, ashishdalal3112@gmail.com, 7988836758
15. Mr. Kapil Kaushik, Assistant Manager, Fire State Bank of India, kapil.kaushik9968@gmail.com, 9466826162
16. Mr. Mayank Badoni, Manager (Fire and Electrical), Reliance, mayankbadoni99@gmail.com, 8076445673
17. Mr. Prince Khutail, Fire and Safety Officer, DLF Mall of India, princekhutail.pk@gmail.com, 7042460505
18. Dr. Jitender Kumar, Head of Department, GITAM, Kablana, hod.fts@gangainstitute.com, 9466962396
19. Mr. Nikhil Sikka, Assistant Professor, GITAM, Kablana, Nikhil.fts@gangainstitute.com, 9416897728
20. Mr. Vikas Goel, Assistant Professor, GITAM, Kablana, vikas.fts@gangainstitute.com, 9991361932
21. Mr. Mohit Taneja, Assistant Professor, GITAM, Kablana, mohit.fts@gangainstitute.com, 9992396913
22. Mr. Vishnu, Assistant Professor, GITAM, Kablana, vishnu.fts@gangainstitute.com, 8054550949
23. Mr. Manoj, Assistant Professor, GITAM, Kablana, manoj.fts@gangainstitute.com, 9992843593
24. Mr. Rajkumar Ruhil, Assistant Professor, GITAM, Kablana, rajkumar.fts@gangainstitute.com, 9999225518
25. Dr. Suman Lata, Associate Professor, GITAM, Kablana, Sumanlata.fts@gangainstitute.com, 9315394398
26. Dr. Aarti, Associate Professor, GITAM, Kablana, aarti.as@gangainstitute.com, 8930082276

Other Domain Courses

The examiner may be appointed from the Panel of Examiners of other relevant Departments of GITAM.

Note: In case of non-availability of examiner from the above panel, the department Head/COE may appoint any other examiner with prior permission from the Director of the Institute.

Chairperson
Board of Studies
Department of Fire Technology and Safety GITAM

~~Annexure 4.7~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)
An Autonomous Institute and 'A' Grade accredited by NAAC
M.Tech (MD, M&A), B. Tech ME
Panel of Examiners (2026-27)

Sr. No.	Name of Examiner	Address	Contact No.
1	Dr. Aman Aggarwal	GITAM KABLANA	8684000901
2	Dr. Vineet Singla	UIET, MDU Rohtak	8168969567
3	Dr. Prabhakar Kaushik	UIET, MDU Rohtak	9896300662
4	Dr. Ashwani Kumar Dhingra	UIET, MDU Rohtak	9034872750
5	Dr. Raj Kumar	UIET, MDU Rohtak	9729900627
6	Dr. Ravinder Kumar Sahdev	UIET, MDU Rohtak	9466547373
7	Dr. Naveen Hooda	UIET, MDU Rohtak	9416958677
8	Mr. Naveen Khatak	UIET, MDU Rohtak	9050409312
9	Mr. Rakesh Rathi	UIET, MDU Rohtak	9416934101
10	Dr. Deepak Chhabra	UIET, MDU Rohtak	9541195456
11	Dr. Rajesh	UIET, MDU Rohtak	9729900627
12	Dr. Pardeep Gahlot	UIET, MDU Rohtak	9813561963
13	Mr. Sandeep Malik	UIET, MDU Rohtak	9466629506
14	Mr. Ravinder Kundu	UIET, MDU Rohtak	9996967284
15	Dr. Hari Singh	NIT, Kurukshetra	9416121266
16	Dr. Gian Bhushan	NIT, Kurukshetra	9416220361
17	Dr. Pankaj Chandna	NIT, Kurukshetra	9896074922
18	Dr. Punit Kumar	NIT, Kurukshetra	8059000776
19	Dr. Dinesh Khanduja	NIT, Kurukshetra	9466960961
20	Dr. P.C. Tiwari	NIT, Kurukshetra	9896434963
21	Dr. Parveen Kumar Saini	NIT, Kurukshetra	9466436664
22	Dr. Vikas Kumar	NIT, Kurukshetra	9468166670
23	Dr. RK Garg	DCRUST, Murthal	9416105066
24	Dr. Suresh Verma	DCRUST, Murthal	9416540458
25	Dr. Avdhesh Kr. Sharma	DCRUST, Murthal	9416722212
26	Dr. Vikas Modgil	DCRUST, Murthal	9466365291
27	Dr. Rajneesh Kumar	DCRUST, Murthal	9466449618
28	Dr. Anil Kumar Narwal	DCRUST, Murthal	9416524459
29	Dr. Ajay Kumar	DCRUST, Murthal	9416101132
30	Dr. Pardeep Sharma	DCRUST, Murthal	9729660266
31	Dr. Vasdev Malhotra	JC Bose UST, YMCA Faridabad	9990201765
32	Dr. Bhupender Singh	JC Bose UST, YMCA Faridabad	9416702828

33	Dr. VN Mathur	MAIT, Rohini, Delhi	9810903760
34	Dr. Rakesh Rajpal	SAITM, Farukh Nagar	9996005451
35	Dr. Sunil Dhingra	UIET Kurukshetra	9541653750
36	Dr. Sanjay	Vishwakarma Skill University	9416745919
37	Dr. Vinkel Kumar Arora	NIFTEM, Sonipat	9467984179
38	Dr. Somvir Arya	BMU, Rohtak	9416505227
39	Mr. Vivek	GITAM KABLANA	8684000891
40	Dr. Jitender Kumar	GITAM KABLANA	8684000892
41	Dr. Hari Parshad	GITAM KABLANA	8684000925
42	Dr. Sunil Kadiyan	GITAM KABLANA	9728950888
43	Dr. Vishant Kumar	GITAM KABLANA	9888924514
44	Mr. Bhoop Singh	GITAM KABLANA	7206550269
45	Mr. Parvesh	GITAM KABLANA	9802154001
46	Mr. Mohit Taneja	GITAM KABLANA	9896008844
47	Mr. Nikhil Sikka	GITAM KABLANA	9416897728
48	Mr. Manoj Kumar	GITAM KABLANA	9992843593
49	Mr. Pardeep Kumar	GITAM KABLANA	9812379868
50	Mr. Bhudev Dixit	DPGITM, Gurugram	9582448539
51	Dr. Bhuvnesh Kumar	SRM University, Sonipat	9466710089
52	Mr. Abhi Bansal	DPGITM, Gurugram	9056785364
53	Mr. Seeone Sharma	PIET, Samalkha	8053001224
54	Mr. Pardeep Kumar	PIET, Samalkha	9729000465
55	Mr. Sidharth Gandhi	PIET, Samalkha	9416801303
56	Dr. Rajesh Kumar	BPIT, Delhi	9992755677
57	Mr. Dharamvir Dixit	BPIT, Delhi	9991442538
58	Dr. Neeraj Kumar	DITM, Sonipat	9255562293
59	Dr. Gyander Ghanghas	SRM, Modi Nagar, Greater Noida	9416247553
60	Dr. Vikas Kumar	SRM, Modi Nagar, Greater Noida	9466713110
61	Dr. Vishal Dabra	PIET, Samalkha	9416259010
62	Mr. Amit Kumar	BRCM, Behal	9255532802
63	Dr. Dinesh	PIET, Samalkha	9416355260
64	Dr. Rajat Sharma	PIET, Samalkha	9813873000
65	Dr. Ranjan Chaudhary	PIET, Samalkha	9416087000
66	Dr. Dharmender	VIPS, Delhi	9541122346
67	Dr. Anil Kumar	GBPCE, Okhla, New Delhi	9355691075
68	Dr. Dinesh Sharma	JCD Vidyapeeth Sirsa	9813082672
69	Dr. Mohit Sharma	MMU, Mullana	7027101662
70	Dr. Mohit Bhargava	MMU, Mullana	7027300993
71	Dr. Ravikant	Amity University, Gurugram	9996195505

72	Dr. Hardial Singh	Amity University, Gurugram	9992359809
73	Mr. Pardeep Sharma	BPIT, Delhi	8398800082
74	Dr. Sandeep Singh Kharb	CRSSIET Jhajjar Silani Kesho	9588319021
75	Dr. Pardeep Khokhar	MRIEM ROHTAK	9991169369
76	Mr. Amit Rana	MRIEM ROHTAK	9813700995
77	Dr. Vaibhav Jain	MAIT, Rohini, Delhi	9868004700
78	Dr. Anil Kumar Dahiya	MAIT, Rohini, Delhi	8130277097
79	Mr. Anil Gupta	MAIT, Rohini, Delhi	9868876407
80	Dr. Sumit Joshi	MAIT, Rohini, Delhi	9997581219
81	Dr. Vipin Kumar Sharma	MAIT, Rohini, Delhi	9582868647
82	Dr. Madhukar Chhimwal	MAIT, Rohini, Delhi	9540318320



Mr. Vivek
Chairperson, Board of Studies
Department of Mechanical Engineering

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS
GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR
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DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

Panel of Theory Paper Setter and Practical Examiners for BCA and MCA

Sr. No	Name of Examiner	Designation	Affiliation / Organization	Contact No.	Email id
1	Dr. Yudhvir Singh	Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9315517965	dr.yudhvirs@gmail.com
2	Dr. Rahul Rishi	Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9812175085	rahulrishi@rediffmail.com
3	Dr. Nasib Singh Gill	Professor	Department of Computer Science & Application, MDU, Rohtak	9050805136	nasib.gill@mdurohtak.ac.in
4	Dr. Shailender Kumar	Professor	Department of Computer Science & Engineering, DTU, Delhi.	9810566485	Shailenderkumar@dce.ac.in
5	Dr. Yogesh Chhaba	Professor	Department of Computer Science & Engineering, Guru Jambeshwar University Science & Technology, Hisar	9416080020	yogeshchaba@yahoo.com
6	Dr. Ashutosh Dixit	Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9873356911	dixit.ashutosh@jcboseust.ac.in
7	Dr. V. P. Vishwakarma	Professor	University School of Information, Communication & Technology, GGSIPU, Dwarka, New Delhi	9891307464	virendravishwa@gmail.com
8	Dr. Amit Prakash Singh	Professor	University School of Information, Communication & Technology, GGSIPU, Dwarka, New Delhi	9899166168	amit@ipu.ac.in
9	Dr. Namita Gupta	Professor	Department of Computer Science & Engineering, Maharaja, Agrasen Institute of Technology (MAIT), Rohini, Delhi	9811257754	namita@mait.ac.in
10	Dr. Parvinder Singh	Professor	Department of Computer Science & Engineering, DCRUST, Murthal, Sonipat	9416108322	parvindersingh.cse@dcrustm.org
11	Dr. Dinesh Singh	Professor	Department of Computer Science & Engineering, DCRUST, Murthal, Sonipat	9466368273	dineshsingh.cse@dcrustm.org
12	Dr. Manoj Kumar	Professor	Department of Computer Science & Engineering, DTU, Delhi	9013057758	mkumarg@dce.ac.in
13	Dr. Vinod Kumar	Professor	Department of Computer Science & Engineering, DTU, Delhi	9811605325	vinod_k@dtu.ac.in

14	Prof.(Dr.) Anil Kumar	Professor	Computer Science and Applications, GITAM, KBLANA	9466350772	Hod.mca@gangainstitute.com
15	Dr. Gopal Singh	Associate Professor	Department of Computer Science & Application, MDU, Rohtak	9896882065	gsbhoria.dcsa@mdurohtak.ac.in
16	Dr. Jyoti	Associate Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9910341139	jyotiverma@jcboseust.ac.in
17	Dr. Vikas Siwach	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416630655	singhvikashuiet@gmail.com
18	Dr. Harkesh Sehrawat	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416486828	sehrawat_harkesh@mdurohtak.ac.in
19	Dr. Kamna Solanki	Associate Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	8053419626	kamna.mdurohtak@gmail.com
20	Dr. Preeti Gulia	Associate Professor	Department of Computer Science & Application, MDU, Rohtak	9467485548	preeti@mdurohtak.ac.in
21	Dr. Pramod	Associate Professor	Department of Computer Science & Engineering, GITAM, Kablana	7419110008	parmod.cse@gangainstitute.com
22	Dr. Sanjeev Indora	Associate Professor	Department of Computer Science & Engineering, DCRUST, Murthal	9466256121	sanjeevindora.cse@dcrustm.org
23	Dr. Kamaldeep	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9416952504	kamalmintwal@gmail.com
24	Dr. Yogesh Kumar	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9050607001	Yogs_crsce@yahoo.com
25	Dr. Bal Kishan	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9416517453	balkishan@mdurohtak.ac.in
26	Dr. Sunita Dhingra	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9255100092	sunitadhingramdu@rediff.com
27	Dr. Pooja Mittal	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	9468110000	pooja@mdurohtak.ac.in
28	Dr. Priti Sharma	Assistant Professor	Department of Computer Science & Application, MDU, Rohtak	8708395855	priti@mdurohtak.ac.in
29	Dr. Karan Singh	Assistant Professor	School of Computer & Systems Sciences, JNU, New Delhi	9971037951	karan@mail.jnu.ac.in
30	Dr. Karan Verma	Assistant Professor	Department of Computer Science & Engineering, NIT Delhi		karanverma@nitdelhi.ac.in.

31	Dr. Manisha Manjul	Assistant Professor	Department of Computer Science & Engineering, G.B. Pant Govt. Engineering College (DSEU), New Delhi	8826367541	manisha.manjul@dseu.ac.in
32	Dr Harish Kumar	Assistant Professor	Department of Computer Science & Engineering, J.C. Bose University of Science and Technology, Faridabad.	9911911782	htanwar@jcboseust.ac.in
33	Dr. Neetu Verma	Assistant Professor	Department of Computer Science & Engineering, DCRUST, Murthal	8708445914	neetuverma.cse@dcrustm.org
34	Dr. Dheer Dhwaj Barak	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9315809071	dheer.rp.uiet@mdurohtak.ac.in
35	Dr. Parveen Kumari	Assistant Professor	Department of Computer Science & Applications, GITAM, KABLANA	9466724124	Parveen.ca@gangainstitute.com
36	Dr. Divya	Assistant Professor	Vivekananda Institute of Professional Studies-Technical Campus, GGSIPU, Delhi	9968362010	er.divya7@gmail.com
37	Dr. Sudesh Yadav	Assistant Professor	Department of Computer Science & Engineering, Govt. PG College Ateli	6467652778	yadavsudesh01@gmail.com
38	Dr. Shweta Rani	Assistant Professor	Department of Computer Science & Engineering, Jaypee Institute of Information Technology (JIIT), Noida	7838423088	shweta.rani@jiit.ac.in
39	Mr. Jitender Singh	Assistant Professor	Department of Computer Science & Applications, GITAM, KABLANA	9891599903	hod.ca@gangainstitute.com
40	Mrs. Minu Rani	Assistant Professor	Department of Computer Science & Applications, GITAM, KABLANA	9050237645	minu.cse@gangainstitute.com
41	Dr. Kavita	Assistant Professor	Department of Computer Science & Applications, GITAM, KABLANA	9255653459	Kavita.ca@gangainstitute.com
42	Mr. Rahul	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	8059413612	rahul.cse@gangainstitute.com
43	Ms. Upasna	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	8295200669	upasna.cse@gangainstitute.com
44	Mr. Jitender Kumar	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	9996439970	jsaini.ymca@gmail.com
45	Mr. Dheeraj Kumar Sahni	Assistant Professor	Department of Computer Science & Engineering, UIET, MDU, Rohtak.	9034882111	dheerajsahni91@gmail.com
46	Ms. Ritu Kadyan	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	7065217140	ritukadyan.cse@gangainstitute.com
47	Dr. Poonam	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	9671719471	poonamdhankhar11@gmail.com

48	Dr. Priyanka Rani	Assistant Professor	Department of Computer Science & Engineering, GITAM, Kablana	7988501899	priyachhillar30@gmail.com
49	Dr Gaurav Aggarwal	Professor	JIMS	9466473777	Gaurav.aggarwal@jagannathuniversityncr.ac.in
50	Dr Vinit lohan	Professor	VCE, Rohtak	9813311878	Vinit.vce@gmail.com
51	Dr Bijender Bansal	Associate Professor	VCE, Rohtak	7404277983	bijender.vce@gmail.com
52	Dr Sugandha Goyal	Associate Professor	VCE, Rohtak	9993683332	sugandha.goel84@gmail.com
53	Dr Pinki Nayak	Professor	ADGIPS, Shastri Park, Delhi	9990017908	pinki.nayak.dua@gmail.com
54	Dr. Niyati Jain	Associate Professor	VCE, Rohtak	7419293392	jainniyatiojas@gmail.com
55	Mr. Shokendra Dev Verma	Assistant Professor	SRM University, Sonipat	9416209222	dev77info@gmail.com
56	Ms.Shalini Bhadola	Assistant Professor	BPIT Rohini, New Delhi	9416016661	shalinibhadola7@gmail.com
57	Priya Panchal	Assistant Professor	BPIT Rohini, New Delhi	7404412119	Priyapanchal774@gmail.com
58	Ms. Pooja	Assistant Professor	Department of Computer Science & Applications, GITAM, KABLANA	8708323507	Pooja.ca@gangainstitute.com

Note: ***For Dissertation / Project (PG) Examination Faculty should posses minimum Ph.D. Degree or not below the rank of Associate Professor. In case of non availability of examiners from above said list, Director of the institute can nominate the expert on his discretion. In addition to the above faculties from institute of National Importance / Eminence viz. IIT's, NIT's, IIIT's, State or Central University and industry personal not below the Manager rank are also eligible with the permission of Director of the Institute.***

Chairperson
Board of Studies
Computer Science and Applications

~~Annexure 4.5~~

Ganga Institute of Technology and Management, Kablana

(An Autonomous Institute under MDU, Rohtak)

List of Courses

S. No.	Course	Class	Domain
1	Entrepreneurship and MSME	BBA	General
2	Principles of Marketing	BBA	Marketing
3	Introduction to Human Resource Management	BBA	HR
4	Business Taxation	BBA	Finance
5	Business Policy and Strategy	BBA	General
6	Computer Networks and Internet	BBA	Computer
7	Computer Networks and Internet	BBA	Computer
8	Internship Report	BBA	Summer Training Report
9	Research Methodology	BBA	General
10	Event Management	BBA	General
11	Financial Management	BBA	Finance
12	Operations and Supply Chain Management	BBA	Operations Management
13	Research Report	BBA	General
14	Entrepreneurship Development	BBA	General
15	Web Development	BBA	Computer
16	Web Development Lab	BBA	Computer
17	Principles and Practices of Management	BBA	General
18	Financial Accounting	BBA	Finance
19	Business Statistics and Logic	BBA	Mathematics, Econometrics
20	Indian Vision for Human Society	BBA	General
21	General English	BBA	English
22	Business Communication-I	BBA	English
23	French	BBA	French
24	Environmental Science and Sustainability	BBA	General
25	Human Behaviour and Organisation	BBA	HR
26	Marketing Management	BBA	Marketing
27	Business Economics	BBA	Economics
28	Media Literacy and Critical Thinking	BBA	General
29	Business Communication-II	BBA	English
30	Hindi	BBA	Hindi
31	Indian Constitution	BBA	General
32	Emerging Technologies and Applications	BBA	Computer
33	Cost and Management Accounting	BBA	Accounting and Finance
34	Legal and Ethical Issues in Business	BBA	General
35	Human Resource Management	BBA	HR
36	Indian System of Health and Wellness	BBA	General
37	Disaster Management	BBA	General
38	Management Information System	BBA	Computer
39	Entrepreneurship and Startup Ecosystem	BBA	General
40	Operations Management	BBA	Operations Management
41	Financial Management	BBA	Finance
42	Business Research Methodology	BBA	General
43	International Business	BBA	International Business
44	Business Environment and Public Policy	BBA	General
45	Design Thinking and Innovation	BBA	Computer
46	Management Process and Organizational Behaviour	MBA	HR

47	Business Research Methods	MBA	General
48	Business Ethics and Communication Skills	MBA	English
49	Business Ethics and Communication Skills Lab	MBA	English
50	Managerial Economics	MBA	Economics
51	Business Environment	MBA	General
52	Personality and Soft Skills Development	MBA	English
53	Personality and Soft Skills Development Lab	MBA	English
54	Strategic Management	MBA	General
55	Summer Internship Report	MBA	General
56	Entrepreneurship Development	MBA	General
57	Project Work	MBA	General
58	Strategic Marketing	MBA	Marketing
59	Digital Marketing	MBA	Marketing
60	Digital Marketing Lab	MBA	Marketing
61	Consumer Behaviour	MBA	Marketing
62	Social Media Marketing	MBA	Marketing
63	Retail Management	MBA	Marketing
64	Service Marketing	MBA	Marketing
65	Marketing Research and Analytics	MBA	Marketing
66	Integrated Marketing Communication	MBA	Marketing
67	Product and Brand Management	MBA	Marketing
68	Sales and Distribution Management	MBA	Marketing
69	Customer Engagement Marketing	MBA	Marketing
70	Advanced Selling and Negotiation Skills	MBA	Marketing
71	Finance for Managers	MBA	Finance
72	Indian Financial System and Financial Services	MBA	Finance
73	Project Management	MBA	Finance
74	Business Taxation	MBA	Finance
75	Behavioral Finance	MBA	Finance
76	Insurance and Risk Management	MBA	Finance
77	Financial and Commodity Derivatives	MBA	Finance
78	International Financial Management	MBA	Finance
79	Investment Management	MBA	Finance
80	FinTech for Business Innovation	MBA	Finance
81	Management of Financial Services	MBA	Finance
82	Strategic Human Resource Management	MBA	HR
83	Emotional Intelligence	MBA	General
84	Compensation Management	MBA	HR
85	Management of Industrial Relations	MBA	HR
86	Cross Cultural Human Resource Management	MBA	HR
87	Indian Labour Legislation	MBA	HR
88	Human Resource Metrics and Analytics	MBA	HR
89	Training and Development	MBA	HR
90	Performance Management Systems	MBA	HR

91	Organizational Change and Intervention Strategies	MBA	HR
92	Leadership and Teamwork in Organisations	MBA	HR
93	Managing Workforce Stress	MBA	HR
94	Computer for Managers-1	MBA	Computer
95	Computer for Managers-1 Lab	MBA	Computer
96	Management Information System	MBA	Computer
97	Computer for Managers-2	MBA	Computer
98	Computer for Managers-2 Lab	MBA	Computer
99	E-Commerce and Applications	MBA	Computer
100	Multimedia and Web Development	MBA	Computer
101	Advanced Database Management System	MBA	Computer
102	AI application in management	MBA	Computer
103	Information Security and Cyber Law	MBA	Computer
104	Business Intelligence and Analytics	MBA	Computer
105	Systems Analysis and Design	MBA	Computer
106	Programming in Visual Basic	MBA	Computer
107	Enterprise Resource Planning	MBA	Computer
108	Data Mining for Business Decisions	MBA	Computer
109	International Trade Theory and Practices	MBA	Economics
110	Export Import Procedure and Documentation	MBA	Economics
111	Foreign Exchange Management	MBA	Economics
112	International Business Environment	MBA	Economics
113	International Business Negotiation and Economic Blocks	MBA	Economics
114	Cross Cultural and Global Management	MBA	HR
115	Management Of Multinational Corporations	MBA	Economics
116	International Logistics	MBA	Operations Management
117	International Marketing	MBA	Marketing
118	International Financial Market	MBA	Finance
119	Agri-Business Environment and Policy	MBA	Economics
120	Agri-Business Management	MBA	Economics
121	Agri-Business Entrepreneurship	MBA	Economics
122	Agricultural Economics	MBA	Economics
123	Agri-Business Finance	MBA	Finance
124	Agricultural Input Marketing And Post- Harvest Management	MBA	Marketing
125	Life Stock Business Management	MBA	Marketing
126	Agricultural Marketing Management	MBA	Marketing
127	Agri Supply Chain and Logistics Management	MBA	Operations Management
128	International Trade in Agri-Business	MBA	Marketing
129	Total Quality Management	MBA	Operations Management
130	Technology and Innovation Management	MBA	Operations Management
131	Supply Chain and Logistics Management	MBA	Operations Management
132	Operations Research	MBA	Mathematics & Statistics

133	R&D Management	MBA	Operations Management
134	Purchasing and Material Management	MBA	Operations Management
135	Transportation Management	MBA	Operations Management
136	Warehouse Management and Inventory Control	MBA	Operations Management
137	Supply Chain Analytics	MBA	Operations Management
138	Service Operations Management	MBA	Operations Management
139	Project Management	MBA	Finance
140	Basics of Business Analytics	MBA	Business Analytics
141	Applied Multivariate Analysis	MBA	Mathematics & Statistics
142	Information Economics and Computers Applications	MBA	Economics
143	Business Data Mining	MBA	Mathematics & Statistics
144	Data Analytics Using R	MBA	Mathematics & Statistics
145	Data Analysis using Excel	MBA	Mathematics & Statistics
146	Data Analysis using Excel Lab	MBA	Mathematics & Statistics
147	Economics for Business Strategy	MBA	Economics
148	Econometrics for Business Analytics	MBA	Economics
149	Predictive Business Analytics	MBA	Mathematics & Statistics
150	Time Series Data Analysis	MBA	Mathematics & Statistics
151	Market Microstructure	MBA	Economics
152	Public Policy Formulation and Evaluation	MBA	Economics
153	Sustainable Development	MBA	Economics
154	Rural Development	MBA	Economics
155	Social Campaign Promotion	MBA	Economics
156	Indian Social and Political System	MBA	Economics
157	Public Finance Administration	MBA	Economics
158	Risk and Disaster Management	MBA	Economics
159	Developmental Economics	MBA	Economics
160	Right To Information Act	MBA	Economics
161	Legal Institutional Dynamics	MBA	Economics

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The panel of Examiners for the Theory/Practical Examination

Domain: General

Sr. No.	Internal Examiner	External Examiner
1.	Dr. Punam Devi, Professor, GITAM 8684000973 punam.mgmt@gangainstitute.com	Dr. Pardeep K. Ahlawat, Professor, MDU IMSAR 9896212988 p_ahlawat@mdurohtak.ac.in
2	Dr. Dipika, Professor, GITAM 7357897397 dipika.mgmt@gangainstitute.com	Dr. Divya Malhan, Professor, IMSAR 8818081199 divyamalhan@mdurohtak.ac.in
3	Dr. Payush, Professor, GITAM 9896220357 payush.mgmt@gangainstitute.com	Dr. Seema Singh Associate Professor IMSAR, MDU 9671200014 dahiyaseema@hotmail.com
4	Mr. Sachin Gupta, Assistant Professor, GITAM 9812658390 sachin.mgmt@gangainstitute.com	Dr. Sanjay Bhayana, Professor, NIFTEM 7082410850 sanjaybhayananiftem@gmail.com
5	Dr. Bhawana Yadav, Associate Professor, GITAM, 7973212525 bhawana.mgmt@gangainstitute.com	Dr. Ashutosh Nigam Professor YMCA, Faridabad 9996015869 E-mail: drashutoshnigam@gmail.com
6	Mr. Joginder Singh Grewal, Assistant Professor, GITAM, 9812667590 Joginder.mgmt@gangainstitute.com	Dr. Karam Pal Narwal, Professor, HSB, GJU&ST 9813705928 E-mail: Karampalhsb@gmail.com
7	Dr. Manisha, Associate Professor, GITAM 8930677011 manisha.mgmt@gangainstitute.com	Dr. Sanjay Nandal, Associate Professor, IMSAR, MDU, 9813233465 Email: sanjaynandal.imsar@gangainstitute.ac.in
8	Ms. Garima, Assistant Professor, GITAM 9728539798 garima.mgmt@gangainstitute.com	Dr. Ishwar Mittal, Associate Professor, IMSAR, Maharshi Dayanand University, Rohtak 9034344549 E-mail: ishwarmittal@gmail.com
9	Ms. Bhumika Samal, Assistant Professor, GITAM, 7988528587 bhumika.mgmt@gangainstitute.com	Dr. Priyanka Yadav Assistant Professor 09050671168 E-mail: drpriyankayadav.imsar@mdurohtak.ac.in
10	Ms. Shalu, Assistant Professor, GITAM 9306335956 shalu.mgmt@gangainstitute.com	Dr. Supriya Dhillon Professor KAIM, 9813163592 supriyadhillon24@gmail.com
11	Ms. Preeti Sharma, Assistant Professor, GITAM 7015340873 preeti.mgmt@gangainstitute.com	Dr. Amit Kumar Singla Assistant Professor, P.I.E.T 9896501000 E-mail:amitsingla.mba@piet.co.in
12		Dr. Saurabh Kant, Assistant Professor, IMSAR,MDU 9416347780 E-mail: Saurabhkant.imsar@mdurohtak.ac.in
13		Dr. Sapna Arora Associate professor, NIFTEM, 9812073783 E-mail: sapna@niftem.ac.in
14		Dr. Pankaj Sharma, IILM University,Greater Noida 9467865790 pankajsharma@iilm.edu

15		Dr. Neetu Munjal, Associate Professor, Hierank Business School Mob.No.-7042550640, WhatsApp -9355990001 E mail-neetumunjal13@gmail.com
16		Dr Rachna Bansal, Associate Professor, Sharda University, Mob. 8826803330 Email rachna.bansal@sharda.ac.in
17		Dr. Poonam, Assistant Professor, CDOE, GJUS&T Mob. 9813899201 Email ID: poonamkaushik@gjust.org
18		Dr. Praveen Kumar,Assistant Professor, MMU 9729004813 phdpraveenk@gmail.com
19		Dr. Anupama Panghal Associate Professor NIFTEM 9466133666 E-mail:-anupama@niftem.ac.in

Ganga Institute of Technology and Management, Kablana

(An Autonomous Institute under MDU, Rohtak)

The panel ofExaminers for the Theory/Practical Examination

Domain: Finance

Sr. No.	Internal Examiner	External Examiner
1.	Dr. Dipika, Professor, GITAM 7357897397 dipika.mgmt@gangainstitute.com	Dr. Karam Pal Narwal, Professor, HSB, GJU&ST 9813705928 E-mail: Karampalhsb@gmail.com
2	Dr. Manisha, Associate Professor, GITAM 8930677011 manisha.mgmt@gangainstitute.com	Dr. Shveta Singh, Professor, HSB, GJU&ST 9896347080 E-mail: shvetaks@yahoo.com
3	Ms. Garima, Assistant Professor, GITAM 9728539798 garima.mgmt@gangainstitute.com	Dr. Ishwar Mittal, Associate Professor, IMSAR, Maharshi Dayanand University, Rohtak 9034344549 E-mail: ishwarmittal@gmail.com
4	Ms. Shalu, Assistant Professor, GITAM 9306335956 shalu.mgmt@gangainstitute.com	Dr. Amit Kumar Singla Assistant Professor, P.I.E.T 9896501000 E-mail:amitsingla.mba@piet.co.in
5	Ms. Preeti Sharma, Assistant Professor, GITAM 7015340873 preeti.mgmt@gangainstitute.com	Dr. Geetanjali Jindal, Associate Professor, KAIM, 9068321080 E-mail: gitujindal11@gmail.com
6		Dr. Sapna Arora Associate professor, NIFTEM, 9812073783 E-mail: sapna@niftem.ac.in
7		Prof. (Dr.) Pooja Yadav, Professor, Management MDU-CPAS, MDU. (M): 9817807085 E mail: pooja.cpas@mdurohtak.ac.in
8		Dr. Rohtash Bhall, Assistant Professor FMS- Parul University (Vadodara), Gujarat (Mob): 9416877300 E mail: rohtashbhall89@gmail.com
9		Dr Vandana Arya, Assistant professor, Department of Commerce, Government College, Sainj (Kullu), HP (Mob): 8708445042 Email I'd: vandanarya1996@gmail.com
10		Dr. Rakhee, Professor, Management Studies, CGC 8146813100 E-mail:rakhee.diwan@gmail.com
11		Dr. Neha, Professor,World college of Techology & Management , Gurgaon, 7206892287 Email: Nehagulia30@gmail.com
12		Dr. Pushpa Rani , World college of Techology & Management , Gurgaon, 9467465621 Email: pushpasangwan9@gmail.com
13		Dr. Pooja Vyas, Professor, IMSAR, Maharshi Dayanand University, Rohtak, 9468269720 Email: pooja.vyas9@gmail.com
14		Dr. Sandeep Agarwal, Assistant professor, CPAS-MDU, Gurugram, 9896879795 Email: sandeep.cpas@mdurohtak.ac.in

15		Prof. Anshu Bhardwaj, BPSMVI, Khapur kalan,9255261003 Email: anshudhansoia@bpswomenuniversity.ac.in
16		Prof. Sushil kumar Jagannath University, 9812042043 Email: dravidsushil5@gmail.com
17		Dr. Shikha, Assistant professor, Indirapuram Institute of Higher Studies (IIHS), 96505 88772 Email: Iihs@gmail.com
18		Dr. Sanjay Nandal, Associate Professor, IMSAR, MDU 9813233465 Email: sanjaynandal.imsar@gangainstitute.ac.in

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The panel ofExaminers for the Theory/Practical Examination

Domain: HR

Sr. No.	Internal Examiner	External Examiner
1.	Dr. Punam Devi, Professor, GITAM 8684000973 punam.mgmt@gangainstitute.com	Dr. Divya Malhan, Professor, IMSAR 8818081199 divyamalhan@mdurohtak.ac.in
2	Dr. Bhawana Yadav, Associate Professor, GITAM 7973212525 bhawana.mgmt@gangainstitute.com	Dr. Pardeep K. Ahlawat, Professor, MDU IMSAR 9896212988 p_ahlawat@mdurohtak.ac.in
3	Mr. Sachin Gupta, Assistant Professor, GITAM 9812658390 sachin.mgmt@gangainstitute.com	Dr Rachna Bansal, Associate Professor, Sharda University, Mob. 8826803330 Email rachna.bansal@sharda.ac.in
4	Mr. Joginder Singh Grewal, Assistant Professor, GITAM 9812667590 Joginder.mgmt@gangainstitute.com	Dr. Priyanka Yadav Assistant Professor 09050671168 E-mail: drpriyankayadav.imsar@mdurohtak.ac.in
5	Dr. Manisha, Associate Professor, GITAM 8930677011 manisha.mgmt@gangainstitute.com	Dr. Saurabh Kant, Assistant Professor, IMSAR,MDU 9416347780 E-mail: Saurabhkant.imsar@mdurohtak.ac.in
6	Ms. Garima, Assistant Professor, GITAM 9728539798 garima.mgmt@gangainstitute.com	Dr. Nitu Nimbrain, Assistant Professor, IMSAR, MDU 916190782 Email: nitin12dass.imsar@mdurohtak.ac.in
7	Ms. Bhumika Samal, Assistant Professor, GITAM 7988528587 bhumika.mgmt@gangainstitute.com	Dr.Neetu Munjal, Associate Professor, Hierank Business School Mob.No.-7042550640, WhatsApp -9355990001 E mail-neetumunjal13@gmail.com
8		Dr. Poonam, Assistant Professor, CDOE, GJUS&T Mob. 9813899201 Email ID: poonamkaushik@gjust.org
9		Dr. Pushpa Rani , World college of Techology & Management , Gurgaon, 9467465621 Email: pushpasangwan9@gmail.com
10		Dr. Ishwar Mittal, Associate Professor, IMSAR, Maharshi Dayanand University, Rohtak 9034344549 E-mail: ishwarmittal@gmail.com
11		Dr. Sapna Jangra, Assistant Professor, , IMSAR, MDU,9416830630, Email: Sapna.jangra11@gmail.com
12		Prof. Azad Singh (Dean), Maharishi University, Noida , 9873729370 Email:azad.singh@muit.in

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The panel ofExaminers for the Theory/Practical Examination

Domain: Marketing

Sr. No.	Internal Examiner	External Examiner
1.	Dr. Dipika, Professor, GITAM 7357897397 dipika.mgmt@gangainstitute.com	Dr. Pardeep K. Ahlawat, Professor, MDU IMSAR 9896212988 p_ahlawat@mdurohtak.ac.in
2	Dr. Payush, Professor, GITAM 9896220357 payush.mgmt@gangainstitute.com	Dr. Seema Singh Associate Professor IMSAR, MDU 9671200014 dahiyaseema@hotmail.com
3	Mr. Sachin Gupta, Assistant Professor, GITAM 9812658390 sachin.mgmt@gangainstitute.com	Dr. Sanjay Bhayana, Professor, NIFTEM 7082410850 sanjaybhayananiftem@gmail.com
4	Mr. Joginder Singh Grewal, Assistant Professor, GITAM, 9812667590 Joginder.mgmt@gangainstitute.com	Dr. Supriya Dhillon, Professor KAIM, 9813163592 supriyadhillon24@gmail.com
5	Ms. Bhumika Samal, Assistant Professor, GITAM, 7988528587 bhumika.mgmt@gangainstitute.com	Dr. Anand Gupta, Professor, KAIM, 7056011555 anandgupta_13@gmail.com
6	Ms. Preeti Sharma, Assistant Professor, GITAM 7015340873 preeti.mgmt@gangainstitute.com	Dr. Sandeep Agarwal, Assistant professor, CPAS-MDU, Gurugram, 9896879795 Email: sandeep.cpas@mdurohtak.ac.in
7		Dr. Pankaj Sharma, IILM University,Greater Noida 9467865790 pankajsharma@iilm.edu
8		Dr.Neetu Munjal, Associate Professor, Hierank Business School Mob.No.-7042550640, WhatsApp -9355990001 E mail-neetumunjal13@gmail.com
9		Prof. (Dr.) Mohita Maggon, MDI Gurgaon (M): 9718587264 E mail ID: Mohita.maggon@mdi.ac.in
10		Dr. Nitu Nimbrain, Assistant Professor, IMSAR, MDU, 916190782 Email: nitin12dass.imsar@mdurohtak.ac.in
11		Dr. Ishwar Mittal, Associate Professor, IMSAR, Maharshi Dayanand University, Rohtak 9034344549 E-mail: ishwarmittal@gmail.com
12		Dr. Sapna Jangra, Assistant Professor, , IMSAR, MDU,9416830630, Email: Sapna.jangra11@gmail.com
13		Prof. Sushil kumar Jagannath University, 9812042043 Email: dravidsushil5@gmail.com
14		Dr. Chand Prakash Saini, Professor, SGT University, 7015345099 Email : chand.saini@sgtuniversity.org

Ganga Institute of Technology and Management, Kablana

(An Autonomous Institute under MDU, Rohtak)

The panel ofExaminers for the Theory/Practical Examination

Domain: International Business

Sr. No.	Internal Examiner	External Examiner
1.	Ms. Shalu, Assistant Professor, GITAM, 9306335956, Email: Shalu.mgmt@gangainstitute.com	Dr. Sanjay Nandal, Associate Professor, IMSAR, MDU 9813233465 Email: sanjaynandal.imsar@gangainstitute.ac.in
2		Dr. Anand Gupta, Professor, KAIM, 7056011555 , anandgupta13@gmail.com
3		Dr. Geetanjali Jindal, Associate Professor, KAIM, 9068321080 E-mail: gitujindal11@gmail.com
4		Dr. Saurabh Kant, Assistant Professor, IMSAR,MDU 9416347780 E-mail: Saurabhkant.imsar@mdurohtak.ac.in
5		Dr Vandana Arya, Assistant professor, Department of Commerce, Government College, Sainj (Kullu), HP (Mob): 8708445042 Email I'd: vandanarya1996@gmail.com
6		Dr. Neha, Professor,World college of Technology & Management , Gurgaon, 7206892287 Email: Nehagulia30@gmail.com
7		Dr. Seema Singh Associate Professor IMSAR, MDU 9671200014 dahiyaseema@hotmail.com

Ganga Institute of Technology and Management, Kablana

(An Autonomous Institute under MDU, Rohtak)

The panel ofExaminers for the Theory/Practical Examination

Domain: Economics

Sr. No.	Internal Examiner	External Examiner
1.	Prof. Punam Devi, HOD, MS, GITAM , Kablana, 8684000973 Email: hod.mgmt@gangainstitute.com	Dr. Anand Gupta, Professor, KAIM, 7056011555 anandgupta_13@gmail.com
2	Dr. Payush, Associate Professor, GITAM , Kablana, 9896220357 Email: Payush.mgmt@gangainstitute.com	Dr. Rohtash Bhall, Assistant Professor FMS- Parul University (Vadodara), Gujarat (Mob): 9416877300 E mail: rohtashbhall89@gmail.com
3	Ms. Garima, Assistant Professor, GITAM, Kablana, 9728539798 Email: garima.mgmt@gangainstitute.com	Dr Vandana Arya, Assistant professor, Department of Commerce, Government College, Sainj (Kullu), HP (Mob): 8708445042 Email I'd: vandanarya1996@gmail.com
4		Dr. Monisha, Tecnia Institute of Advanced Studies ,9467926449 Email: Mgv.bmiet@gmail.com

Ganga Institute of Technology and Management, Kablana

(An Autonomous Institute under MDU, Rohtak)

The panel ofExaminers for the Theory/Practical Examination

Domain: Operations Management

Sr. No.	Internal Examiner	External Examiner
1.		Dr. Pooja Vyas, Professor, IMSAR, Maharshi Dayanand University, Rohtak, 9468269720 Email: pooja.vyas9@gmail.com
2		Dr.Anupama Prashar Associate Professor MDI Gurgaon 91-124-4560292 E-mail:anupama.prashar@mdi.ac.in
3		Dr. Amit Kumar Gupta Associate Professor MDI Gurgaon 91-124-4560340 E-mail:amitkgupta@mdi.ac.in
4		Dr. Bhanwar Singh Assistant Professor University School of Management Kurukshetra University, Kurukshetra 9996625112 E-mail:write2bhanwar@kuk.ac.in

Ganga Institute of Technology and Management, Kablana

(An Autonomous Institute under MDU, Rohtak)

The panel ofExaminers for the Theory/Practical Examination

Domain: Business Analytics

Sr. No.	Internal Examiner	External Examiner
1.		Dr. Yashesh Zaveri Associate Prof. FMS- Parul University (Vadodara), Gujarat (Mob): +91 99798 56579 E mail ID: yashesh.zaveri29542@paruluniversity.ac.in Spl- Business Analytics
2		Dr. Poonam, Assistant Professor, CDOE, GJUS&T Mob. 9813899201 Email ID: poonamkaushik@gjust.org
3		Dr. Geetanjali Jindal, Associate Professor, KAIM, 9068321080 E-mail: gitujindal11@gmail.com
4		Dr. Vikas Kumar Assistant Professor, (FBM&ED), Niftem, Kundli 9780351895 Email: vikaskumarpu@gmail.com
5		Prof. Anil Kumar Mittal Professor Kurukshetra University 9812093320 Email Id:mittal_anil_kuk@yahoo.com

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR

(An Autonomous Institute under Maharshi Dayanand University, Rohtak and Accredited with NAAC'A' Grade)

DEPARTMENT OF APPLIED SCIENCE & HUMANITIES

Panel Physics Theory Paper Setter and Examiners for B.Tech

Sr. No.	Name	Designation and Affiliation	Email ID	Contact No.
1	Dr. A.S.Maan	Professor, Department of Physics, MDU,Rohtak	asmaan66@rediffmail.com	+91-1262-393345
2	Dr. Kulvinder Singh	Professor, DDU, Delhi University	kulvinder@ddu.du.ac.in	9811998997
3	Dr. Rajesh Punia	Professor, MDU, Rohtak	rajeshpunia.phys@mdurohtak.ac.in	9215701113
4	Dr. Satish Khasa	Professor, Department of Physics, DCRUST, Murthal	Skhasa.phy@dcrustm.org	9812818900
5	Dr. Sanjay Kumar Dahiya	Professor, Department of Physics, MDU, Rohtak	ps_du@yahoo.co.in	9416414099
6	Dr. Rajesh Parmar	Professor, Department of Physics, MDU, Rohtak	rparmar1969@gmail.com	09416516507
7	Dr. Rajender Singh Kundu	Professor, Department of Physics, GJUS&T, Hisar	rskundu2007@gmail.com	8199972180
8	Dr. Fakir Chand	Professor, Department of Physics, K.U, Kurukshetra	fchand@kuk.ac.in	01744- 238410
9	Prof. (Dr).Neetu Ahlawat	Professor, Department of Physics, GJUS&T, Hisar	neetugju@yahoo.co.in	01662- 263389
10	Dr. Anurag Jain	Professor, GITAM, Kablana	anurag.as@gangainstitute.com	8076304041
11	Dr. Sweta Chauhan	Professor, GITAM, Kablana	swetachauhan.as@gangainstitute.com	8287209105
12	Dr. Surender Duhan	Associate Professor , DCRUST, Murthal	surender6561@gmail.com	9813170944
13	Dr. Hardev S. Saini	Associate Professor, Department of Physics, GJUS&T, Hisar	hardev1984@gjust.org	9728915004
14	Dr.Sunil kumar	Associate Professor, Department of Physics, Indira Gandhi University, Meerpur, Rewari	sunilkumar32@igu.ac.in	8284994077
15	Dr. Sukhbir Singh	Assistant Professor, UIET, MDU,Rohtak	sukhuhooda@gmail.com	9728609994
16	Dr. Ashok Kumar	Assistant Professor ,DCRUST, Murthal	ashokkumar.phy@dcrustm.org	9416573692
17	Dr. Manjeet Singh	Assistant Professor ,Govt. College Matanhail, Jhajjar	manjeetgur@gmail.com	8607667800

HOD AS

18	Dr. Rajni Bala	Assistant Professor, MDU Rohtak	khattak.rajni@gmail.com	9355549051
19	Dr. Parveen Kumar	Assistant Professor, Govt., PG,NehruCollege, Jhajjar	dr.parveengulia@gmail.com	8010192892
17	Ms. Kshitij Upadhyay	Assistant Professor, GITAM, Kablana	kshitij.as@gangainstitute.com	8930474124
18	Mr. Mahender Pal	Assistant Professor, GITAM, Kablana	mpsingh2111988@gmail.com	9812473079
19	Dr. Anshu	Assistant Professor, Maharani Kishori Jat Kanya Mahavidyalaya, Rohtak	anshumalik30@gmail.com	9813913593
20	Dr. Savita	Assistant Professor, Sh. Lal Nath Hindu College, Rohtak	savita.devi.Inhcr@gmail.com	9350696240
21	Dr. Arun Kumar	Assistant Professor, Govt. College Bahadurgarh	arun250981@gmail.com	9992087372
22	Dr. Anurag Gaur	Assistant Professor, Department of Physics, NIT Kurukshetra	anuragdph@nitkkr.ac.in	9896087178
23	Dr. Neetika Chauhan	Assistant Professor, Department of Physics, NIT Kurukshetra	neetika.nit@gmail.com	9355999423
24	Dr. David Joseph	Assistant Professor, Department of Physics, GJUS&T, Hisar	davidjoseph@gjust.org	01662-263520
25	Dr.Sajjan	Assistant Professor, MDU, Rohtak	sajjandahiya1@gmail.com	9991279660
26	Dr.Anil Ohlan	Assistant Professor, Department of Physics, MDU, Rohtak	anilohlan.physics@mdurohtak.ac.in	9671751435

Note: In addition to the above, the regular faculty members of IITs, NITs, IIITs, State and Central Universities and Colleges may be appointed as paper setter for Physics Related Courses with prior approval of Director.

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DEPARTMENT OF APPLIED SCIENCE & HUMANITIES

Panel of Mathematics Theory Paper Setter and Examiners for B.Tech

Sr. No.	Name	Designation and Affiliation	Email ID	Contact No.
1	Prof. Rajeev Kumar	Professor, Department of Mathematics, MDU, Rohtak	drrajeevmdu@gmail.com	09896009959
2	Prof.Gulshan Lal Taneja	Professor, Department of Mathematics, MDU, Rohtak	drgtaneja@gmail.com	09896255069
3	Prof. Renu Chugh	Professor, Department of Mathematics, MDU, Rohtak	chughr.1@gmail.com,chughrenu1988@gmail.com	9991132199, 9215843233
4	Prof.S.C.Malik	Professor, Department of Statistics, MDU, Rohtak	sc_malik@rediffmail.com	9813104668
5	Prof. Jitander Singh Sikka	Professor, Department of Mathematics, MDU, Rohtak	sikkajs@yahoo.in	09215636160
6	Prof. Dalip Singh	Professor, Department of Mathematics, MDU, Rohtak	dsmdur@gmail.com	9255121164
7	Prof. Seema Mehra	Professor, Department of Mathematics, MDU, Rohtak	sberwal2007@gmail.com,sberwal2007.math@mdurohtak.ac.in	01262-274081, 9468267369
8	Prof. A.S.V. Ravikanth	Professor, Department of Mathematics, NIT Kurukshetra	asvravikanth@yahoo.com	9896031557
9	Prof. ParasRam	Professor, Department of Mathematics, NIT Kurukshetra	parasram123@nitkkr.ac.in	9416539758
10	Prof. Phool Singh	Professor, Department of Mathematics, Central University of Haryana	phoolsingh@cuh.ac.in	8376959182
11	Prof. Rajesh Gupta	Professor, Department of Mathematics, Central University of Haryana	rajeshgupta@cuh.ac.in	01285-260180
12	Prof. A.K. Yadav	Professor, Department of Mathematics, Central University Of Haryana	akyadav@cuh.ac.in	
13	Prof. Sunita Pannu	Professor, Department of Mathematics, GJUS&T, Hisar	spannu_gju@yahoo.com	01662-263574
14	Prof. Sunita Rani	Professor, Department of Mathematics, GJUS&T, Hisar	s_b_rani@rediffmail.ocm	01662-263574

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15	Prof. Mukesh KumarSharma	Professor, Department of Mathematics, GJUS&T, Hisar	drms123@gmail.com	01662-263574
16	Prof. Pankaj Kumar	Professor, Department of Mathematics, GJUS&T, Hisar	joshipankajkumar@gmail.com	01662-263574
17	Prof. Kapil Kumar	Professor, Department of Mathematics, GJUS&T, Hisar	kapilkalkal_gju@gjust.org	01662-263574
18	Dr. Amit Mahajan	Associate Professor, Mathematics, NIT Delhi	amitmahajan@nitdelhi.ac.in	+9111-33861254 (O)
19	Dr. Sandeep Singh Sheoran	Assistant Professor, Department of Mathematics,GJUS&T, Hisar	sandeep_gjtu@yahoo.co.in	94660 37643
20	Dr.Vikas Poply	Associate Professor, Department of Mathematics, Kurukshetra University	vikaspoply@gmail.com	9034797001
21	Dr. Savita Rathee	Assistant Professor, Department of Mathematics, MDU, Rohtak	dr.savitarathee@gmail.com	
22	Dr. Anju	Assistant Professor, Department of Mathematics, MDU, Rohtak	anjupanwar15@gmail.com	
23	Dr. Jagbir Singh	Assistant Professor, Department of Mathematics, MDU, Rohtak		
24	Dr. Ekta Narwal	Assistant Professor,Department ofMathematics, MDU, Rohtak	ekta_narwal@yahoo.com,ektanarwal.math@mdurohtak.ac.in	
25	Dr. Meenakshi	Assistant Professor, Department of Mathematics, MDU, Rohtak	mshthebest@gmail.com	9468267369
26	Dr. Poonam Redhu	Assistant Professor, Department of Mathematics, MDU, Rohtak	poonamr@iitrpr.ac.in, poonamr.maths@mudrohtak.ac.in	7307914600
27	Dr. Arun Kajla	Assistant Professor, Department of Mathematics, Central University of Haryana	arunkajla@cuh.ac.in	7988173235
28	Dr. Paramjeet Sangwan	Professor, GITAM, Kablana	paramjeet.as@gangainstitute.com	9467508896
29	Mr.Kuldeep	Assistant Professor, GITAM Kablana	kuldeep.as@gangainstitute.com	9728107146
30	Mr. Aseem	Assistant Professor, GITAM Kablana	aseem.as@gangainstitute.com	9812756057

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DEPARTMENT OF APPLIED SCIENCE & HUMANITIES

Panel of Chemistry Theory Paper Setter and Examiners for B.Tech

Sr. No.	Name	Designation and Affiliation	Email ID	Contact No.
1	Prof.(Dr.) S.P. Khatkar	Professor, Department of Chemistry, Maharshi Dayanand University, Rohtak	s_khatkar@rediff.com	9813805666
2	Prof.(Dr.) Harish Kumar	Professor, Central University of Haryana, Mahendergarh	harishkumar@cuh.ac.in	7206077870
3	Prof.(Dr.) Neera Raghav	Professor, Department of Chemistry, KUK, Kurukshetra	dr.neeraraghav.kuk@gmail.com	9896918277
4	Prof.(Dr.)Pawan KumarSharma	Professor, Central University of Haryana, Mahendergarh	talk2pawan@cuh.ac.in	9416457355
5	Prof.(Dr.) Sapana Garg	Professor, Department of Chemistry, MDU Rohtak	sapanagarg1511@gmail.com	9896091443
6	Dr.Sangeeta	Associate Professor, Department of Chemistry, KUK, Kurukshetra	ssangeeta.saini@kuk.ac.in	9416979650
7	Dr.Suresh Kumar	Associate Professor, Department of Chemistry, KUK, Kurukshetra	sureshkum@kuk.ac.in	9215864888
8	Dr. Rashmi Pundeer	Associate Professor, Department of Chemistry, Indira Gandhi University,Meerpur	rashmi.chem@igu.ac.in	9034310036
9	Dr.NaveenKumar	Associate Professor,Department of Chemistry, MDU Rohtak	naveenkumar.chem@mdurohtak.ac	9996415102
10	Dr.Seema	Associate Professor, UIET, MDU, Rohtak	seemabhayana15@gmail.com	9416496540
11	Dr. Urmila	Associate Professor, Department of Applied Sciences, UIET, Kurukshetra	urani2015@kuk.ac.in	9466271317
12	Dr. Mayank Kinger	Associate Professor, Department of Chemistry, Chaudhary Bansi Lal University, Bhiwani	mayank.kinger@yahoo.com	9034359496
13	Dr. Bindu Mangla	Associate Professor, Department of Chemistry, J.C. Bose University of Science and Technology, YMCA Faridabad	bindumangla@jcboseust.ac.in	9868377463
14	Dr. Gulshan Singh	Associate Professor, Department of Chemistry, Gurugram University, Gurugram	gulshansingh@gurugramuniversity.ac.in	9416116490
15	Dr. Monalisa	Associate Professor, Department of Chemistry, PDM University, Bahadurgarh	monalisa.boruah@pdm.ac.in	8822398028
16	Dr. Rakesh Kumar	Associate Professor, Govt.,PG, Nehru College, Jhajjar	rakesh.pasrija@gmail.com	9992511845
17	Dr. Sita Ram	Assistant Professor, Department of Chemistry, J.C. Bose University of Science and Technology, YMCAFaridabad	sitaram@jcboseust.ac.in	9728552956

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18	Dr. Rajender Konidena	Assistant Professor, Department of Chemistry, IIT Patna	rajsan@iitp.ac.in	9542747375
19	Dr. Savita Khatri	Assistant Professor,UIET,MDU, Rohtak	khatri.rtk@gmail.com	7082947268
19	Dr. Nishant Verma	Assistant Professor,Swami Shraddhanand College,DU, Delhi	nishantverma@ss.du.ac.in	8126695049
20	Dr. Bhavani Prasad	Assistant Professor, Department of Applied Sciences and Humanities, IGDTUW,Delhi	bhavaniprasadnaik@igdtuw.ac.in	8826629331
21	Ms. Priti	Assistant Professor, Govt.,PG, Nehru College, Jhajjar	preetikhanna1012@gmail.com	8168588125
22	Ms. Reena Kumari	Assistant Professor, Govt. College, Bahadurgarh	reenadagar89@gmail.com	8930516857
23	Dr. Ashima	Assistant Professor, Govt. College for Women, Bahadurgarh	gcwbahadurgarh@rediffmail.com	9541330851
25	Ms. Shammy Laj	Assistant Professor, GPGCW, Rohtak	lajshammy@gmail.com	8930417711
26	Dr. Surila	Assistant Professor, Govt., PG, Nehru College, Jhajjar	surilachanderbhan@gmail.com	7988754069
27	Dr. Minakshi	Assistant Professor, Govt., PG, Nehru College, Jhajjar	minakshiphogat86@gmail.com	9992039686
28	Dr. Rajeev Kumar	Assistant Professor, Govt. College,Bahadurgarh	rajeevasiwal31@gmail.com	9991514660
29	Dr. Prem Ballabh	Associate Professor, GITAM, Kablana	prem222ballabh@gmail.com	8700579623
30	Dr. Ankita Saini	Assistant Professor, GITAM, Kablana	ankitasaini53@gmail.com	8791532775
31	Dr. Aarti	Assistant Professor,GITAM, Kablana	aarti.chem4812@gmail.com	8930082276

Note: In addition to the above, the regular faculty members of IITs, NITs, IIITs, State and Central Universities and Colleges may be appointed as paper setter for Mathematics Related Courses with prior approval of Director.



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DEPARTMENT OF APPLIED SCIENCE & HUMANITIES

Panel of English Theory Paper Setter and Examiners for B.Tech

Sr. No.	Name	Designation and Affiliation	Email ID	Contact No.
1	Prof.(Dr.) Jyoti Sheoran	Professor & Head, Department of English, Govt. College, Jind	Jyotisheoran2009@rediffmail.com	8570839857
2	Prof. (Dr.) DivyaJyoti Singh	Professor, Department of Literature and Languages, JC Bose University of Science and Technology, YMCA, Faridabad	divyajyoti@jcboseust.ac.in	9911818658
3	Prof. (Dr.) Sanjiv Kumar	Professor, Central University, Mahendergarh	sanjivkumar@cu.ac.in	9416132765
4	Prof. (Dr.) Randeep Rana	Professor, English & Foreign Languages, MDU, Rohtak		
5	Prof.(Dr.)Kiran Sharma	Professor, I C College, Rohtak	kkiran14.sharma1@gmail.com	9467405627
6	Prof.(Dr.) Sudhir Kumar	Professor, MDU,Rohtak	sudhir.eng@mdurohtak.ac.in	9466315140
7	Prof.(Dr.)Jyoti Sheoran	Professor, CRSU, Jind		
8	Dr. Anju Mehra	Associate Professor, MDU, Rohtak	anjum780@gmail.com	9467666352
9	Dr. Manoj Kumar	Associate Professor, CUH, Mahendergarh	manojkumar@cuh.ac.in	8222071888
10	Dr. Mayur Chhikara	Associate Professor, DCRUST, Murthal	mayur.hum@dcrustm.org	9215192446
11	Dr. SikhaGoel	Principal, JCD Memorial College Sirsa		8818086116
12	Dr.Vikas Shokeen	Associate Professor, Govt.College, Bahadurgarh	vikahshokeen15@gmail.com	9015648324
13	Dr.Chitralekha	Associate Professor, Maharaja Agrasen College for Women, Jhajjar	chitralekha1969@gmail.com	9416322834
14	Dr. D.P.Singh	Associate Professor, NBGSM College Sohna, Gurugram	dpsdevendra@gmail.com	9891136240
15	Dr.Ajay Vashisht	Associate Professor, Govt. College, Loharu, Bhiwani	drajayvashishthm51@gmail.com	8587968609
16	Mr.Shri Kishan	Associate Professor, Govt., PG, Nehru College, Jhajjar	kishanchahar37@gmail.com	9467214677
17	Dr. SnehLata Sharma	Assistant Professor,CBLU, Bhiwani	sneh.english@cblu.ac.in	9813247292
18	Dr. Sudeep Kumar	Assistant Professor, CUH, Mahendergarh	sudeepkumar@cuh.ac.in	9467714501
19	Dr. Rinu	Assistant Professor, CUH, Mahendergarh	rinueng@cuh.ac.in	8222888271

20	Dr. SakshiJain	Assistant Professor, GJUS&T, Hisar	dr.sj.mittal@gmail.com	9115555532
21	Dr. Jaidev Bishnoi	Assistant Professor,GJUST, Hisar	jaidev@gjust.org	9417488391
22	Dr.Savi Khera	Assistant Professor, Gurugram University, Gurugram	savi.eng@gugramuniversity.ac.in	7206926348
23	Dr.Mamta Rani	Assistant Professor,CRSU, Jind	mattodhanda@gmail.com	8818034348
24	Dr. Pradeep Singh	Assistant Professor, DCRUST, Murthal	pardeep.hum@dcrustm.org	8818000084
25	Dr. Dharmendra Singh	Assistant Professor, DCRUST, Murthal	dharmendrasingh.hum@dcrustm.org	9034632505
26	Dr. Sanjana Antil	Assistant Professor, Gurugram University, Gurugram	sanjana.eng@gurugramuniversity.ac.in	8607852700
27	Dr. Deepak Lathwal	Assistant Professor, Govt.College, Sampla	dlathwal78@gmail.com	9416690792
28	Dr. Anoopama Yadav	Assistant Professor, Maharaja Agrasen college for Women, Jhajjar	yadavanoopama@gmail.com	7404284232 7015909938
29	Dr. Sumit Kumari Dahiya	Assistant Professor, Sh. Lal Nath Hindu College,Rohtak	dr.sumitdahiya11@gmail.com	9813121980
30	Dr. Manju Sharma	Assistant Professor, Gaur College, Rohtak	manju.shine2011@gmail.com	9996333877
31	Dr. Ramesh	Assistant Professor, Govt.College, Badli	rameshkumar25982@gmail.com	9540439235
32	Mr. Randeep Singh	Assistant Professor, Govt, college, Dubaldhan, Haryana	profrandeep@gmail.com	9416851515
33	Ms. Suman Singh	Assistant Professor, GITAM Kablana	sumansingh.as@gangainstitute.com	7988509423
34	Prof. (Dr.) SumanDevi	Professor, GITAM, Kablana	suman.as@gangainstitute.com	9466381004
35	Ms. Aditi Kashyap	Assistant Professor, GITAM Kablana	aditikashyap19@gmail.com	8295600554

Note: In addition to the above, the regular faculty members of IITs, NITs, IIITs, State and Central Universities and Colleges may be appointed as paper setter for Communication Skill Related Courses with prior approval of Director.



Annexure AC/5.52

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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04-05-2026

The Director
GITAM, Kablana
Jhajjar (Haryana)

Sub: Request for replacement of Expert Member of English in Board of Studies

Respected Sir,

I request approval to withdraw the name of Prof. Divya Jyoti (Department of Literature and Language, JC Bose University of Science and Technology, Faridabad) from the Board of Studies due to non-availability of her as communicated.

In her place, I propose to include Prof. Jyoti Sheoran (Professor, and Head of Department of English, Govt. College, Jind, Haryana) formerly Dean Humanities and Indic Studies, CRS University, Jind.
Her details are as follow:
Contact no: 8570839857
Email id: jyotisheoran2009@rediffmail.com

Kindly approve the replacement and issue the necessary notification.

Thanking You.

Yours Sincerely,
Anurag
Dr. Anurag Jain
(Chairperson - BOS
HOD - Applied Science & Humanities)

Recommended for consideration in academic council

Gmail HOD.AS GITAM <hod.as@gangainstitute.com>

Inability to Continue as Member of BoS(Outside Expert)

1 message

divya jyoti <divyajyoti@jcboseust.ac.in> Fri, Feb 27, 2026 at 2:05 PM
To: "HOD.AS GITAM" <hod.as@gangainstitute.com>

Dear Dr Anurag Jain,

It was a valuable experience to serve as a member of the Board of Studies, Department of Applied Sciences and Humanities of your esteemed institution. However, diverse in-house duties and other research/academic engagements make my participation as a proactive member rather difficult and untenable. Therefore, it is requested to kindly explore an alternative arrangement.

Thanking you,

Warm regards,

Divyajyoti Singh
Professor and Chairperson,
Department of Literature and Languages,
JC Bose UST, YMCA, Faridabad, Haryana.