SILVER HORIZONS 25 YEARS OF GLOBAL LEARNING

NEW HORIZON COLLEGE OF ENGINEERING

Department of Applied Sciences

Academic Year : 2026-27

1st and 2nd Semester BE

Scheme & Syllabus

Batch 2026-30

Credits: 160

NEW HORIZON COLLEGE OF ENGINEERING

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.

To encourage long-term interaction between the academia and industry through their involvement in the design of the curriculum and its hands-on implementation.

To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

DEPARTMENT OF APPLIED SCIENCES

VISION

To build strong and sustainable platform for churning out quality students bearing appreciable conceptual knowledge and engineering mind sets to their respective branch department(s)

MISSION

To develop and nurture dedicated teaching-learning team equipped with strong personality traits towards application driven approach, encompassing all stakeholders

QUALITY POLICY

To provide educational services of the highest quality both curricular and co-curricular to enable students to integrate skills and serve the industry and society equally well at a global level.

VALUES

Academic Freedom
Integrity
Professionalism
Innovation
Inclusiveness
Social Responsibility

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes as defined by NBA (PO)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyse and evaluate societal and environmental aspects while solving complex engineering problems for their impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

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NEW HORIZON COLLEGE OF ENGINEERING

First Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

AIML **Chemistry Cycle**

S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	ASC	25MAT11	Applied Mathematics for Engineers – I	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25CHE12	Applied Chemistry for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25CHL12	Applied Chemistry Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC -I	25ESC132	Introduction to Electrical Engineering	EEE	3	0	0	0	3	4	50	50	**100**
5	PSC	25CSE144	Problem solving using Python	AIML	3	0	0	0	3	4	50	50	**100**
6	PSC	25CSL144	Problem solving using Python Lab	AIML	0	0	1	0	1	2	50	50	**100**
7	ESC	25CAD15	Computer Aided Engineering Drawing	ME	2	0	1	0	3	5	50	50	**100**
8	AEC	25ENG16	AI-Powered Communicative English	HSS	0	0	1	0	1	2	50	50	**100**
9	NCMC	25CIP17	Constitution of India and Professional Ethics	HSS	0	0	0	0	PP	1	100	-	**100**
10	AEC	25EDM18	Environment and Disaster Management	AS	1	0	0	0	1	1	50	50	**100**
TOTAL									**20**	**30**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

Second Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

AIML												Physics Cycle		
S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	ASC	25MAT21	Applied Mathematics for Engineers – II	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25PHY22	Applied Physics for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25PHL22	Applied Physics Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC-II	25ESC231	Introduction to Electronics and Communication Engineering	ECE	3	0	0	0	3	4	50	50	**100**
5	PLC	25PLC24	Programming in C	CS	3	0	0	0	3	4	50	50	**100**
6	PLC	25PCL24	Programming in C Lab	CS	0	0	1	0	1	2	50	50	**100**
7	ETC	25ETC25	Introduction to AI and Applications	ME	3	0	0	0	3	4	50	50	**100**
8	AEC	25UHV26	UHV and Indian Ethos	HSS	0	0	0	0	PP	2	100	-	**100**
9	HSS	25KSK27 / 25KBK27	Samskrithika Kannada/ Balake Kannada	HSS	1	0	0	0	1	2	50	50	**100**
10	AEC	25IPL28	Inter-Disciplinary Project Based Learning	AS	0	0	0	1	1	2	50	50	**100**
Total									**20**	**31**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

First Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

CSE												Physics Cycle		
S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CI E	SEE	Total
1	ASC	25MAT11	Applied Mathematics for Engineers – I	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25PHY12	Applied Physics for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25PHL12	Applied Physics Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC-I	25ESC131	Introduction to Electronics and Communication Engineering	ECE	3	0	0	0	3	4	50	50	**100**
5	PSC	25CSE144	Problem solving using python	AIML	3	0	0	0	3	4	50	50	**100**
6	PSC	25CSL144	Problem solving using python Lab	AIML	0	0	1	0	1	2	50	50	**100**
7	ETC	25ETC15	Introduction to AI and Applications	ME	3	0	0	0	3	4	50	50	**100**
8	AEC	25UHV16	UHV and Indian Ethos	AS	0	0	0	0	PP	1	100	-	**100**
9	HSS	25KSK17 / 25KBK17	Samskrutika Kannada/ Balake Kannada	HSS	1	0	0	0	1	2	50	50	**100**
10	AEC	25IPL18	Inter-Disciplinary Project Based Learning	AS	0	0	0	1	1	2	50	50	**100**
Total									**20**	**30**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

Second Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

CSE											Chemistry Cycle		
S. No	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	ASC	25MAT21	Applied Mathematics for Engineers – II	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25CHE22	Applied Chemistry for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25CHL22	Applied Chemistry Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC -II	25ESC232	Introduction to Electrical Engineering	EEE	3	0	0	0	3	4	50	50	**100**
5	PLC	25PLC24	Programming in C	CS	3	0	0	0	3	4	50	50	**100**
6	PLC	25PCL24	Programming in C Lab	CS	0	0	1	0	1	2	50	50	**100**
7	ESC	25CAD25	Computer Aided Engineering Drawing	ME	2	0	1	0	3	5	50	50	**100**
8	AEC	25ENG26	AI-Powered Communicative English	HSS	0	0	1	0	1	2	50	50	**100**
9	HSS	25CIP27	Constitution of India and Professional Ethics	HSS	0	0	0	0	PP	1	100	-	**100**
10	AEC	25EDM28	Environment and Disaster Management	AS	1	0	0	0	1	1	50	50	**100**
				Total					**20**	**30**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

First Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

ECE											Chemistry Cycle		
S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	ASC	25MAT11	Applied Mathematics for Engineers – I	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25CHE12	Applied Chemistry for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25CHL12	Applied Chemistry Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC -I	25ESC132	Introduction to Electrical Engineering	EEE	3	0	0	0	3	4	50	50	**100**
5	PSC	25ECE141	Elements of Electronics and Communication Engineering	ECE	3	0	0	0	3	4	50	50	**100**
6	PSC	25ECL141	Elements of Electronics and Communication Engineering Lab	ECE	03	0	1	0	1	2	50	50	**100**
7	ESC	25CAD15	Computer Aided Engineering Drawing	ME	2	0	1	0	3	5	50	50	**100**
8	AEC	25ENG16	AI-Powered Communicative English	HSS	0	0	1	0	1	2	50	50	**100**
9	NCMC	25CIP17	Constitution of India and Professional Ethics	HSS	0	0	0	0	PP	1	100	-	**100**
10	AEC	25EDM18	Environment and Disaster Management	AS	1	0	0	0	1	1	50	50	**100**
Total									**20**	**30**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

Second Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

ECE												Physics Cycle		
S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Tot al
1	ASC	25MAT21	Applied Mathematics for Engineers – II	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25PHY22	Applied Physics for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25PHL22	Applied Physics Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC-II	25ESC233	Introduction to Mechanical Engineering	ME	3	0	0	0	3	4	50	50	**100**
5	PLC	25PLC24	Programming in C	CS	3	0	0	0	3	4	50	50	**100**
6	PLC	25PCL24	Programming in C Lab	CS	0	0	1	0	1	2	50	50	**100**
7	ETC	25ETC25	Introduction to AI and Applications	ME	3	0	0	0	3	4	50	50	**100**
8	AEC	25UHV26	UHV and Indian Ethos	HSS	0	0	0	0	PP	2	100	-	**100**
9	HSS	25KSK27 / 25KBK27	Samskrithika Kannada/ Balake Kannada	HSS	1	0	0	0	1	2	50	50	**100**
10	AEC	25IPL28	Inter-Disciplinary Project Based Learning	AS	0	0	0	1	1	2	50	50	**100**
				Total					**20**	**31**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

First Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

EEE
Chemistry Cycle

S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	ASC	25MAT11	Applied Mathematics for Engineers – I	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25CHE12	Applied Chemistry for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25CHL12	Applied Chemistry Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC -I	25ESC133	Introduction to Mechanical Engineering	ME	3	0	0	0	3	4	50	50	**100**
5	PSC	25EEE142	Elements of Electrical Engineering	EEE	3	0	0	0	3	4	50	50	**100**
6	PSC	25EEL142	Elements of Electrical Engineering lab	EEE	0	0	1	0	1	2	50	50	**100**
7	ESC	25CAD15	Computer Aided Engineering Drawing	ME	2	0	1	0	3	5	50	50	**100**
8	AEC	25ENG16	AI-Powered Communicative English	HSS	0	0	1	0	1	2	50	50	**100**
9	NCMC	25CIP17	Constitution of India and Professional Ethics	HSS	0	0	0	0	PP	1	100	-	**100**
10	AEC	25EDM18	Environment and Disaster Management	AS	1	0	0	0	1	1	50	50	**100**
Total									**20**	**30**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

Second Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

EEE												Physics Cycle		
S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Tot al
1	ASC	25MAT21	Applied Mathematics for Engineers – II	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25PHY22	Applied Physics for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25PHL22	Applied Physics Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC-II	25ESC231	Introduction to Electronics and Communication Engineering	ECE	3	0	0	0	3	4	50	50	**100**
5	PLC	25PLC24	Programming in C	CS	3	0	0	0	3	4	50	50	**100**
6	PLC	25PCL24	Programming in C Lab	CS	0	0	1	0	1	2	50	50	**100**
7	ETC	25ETC25	Introduction to AI and Applications	ME	3	0	0	0	3	4	50	50	**100**
8	AEC	25UHV26	UHV and Indian Ethos	HSS	0	0	0	0	PP	2	100	-	**100**
9	HSS	25KSK27 / 25KBK27	Samskrithika Kannada/ Balake Kannada	HSS	1	0	0	0	1	2	50	50	**100**
10	AEC	25IPL28	Inter-Disciplinary Project Based Learning	AS	0	0	0	1	1	2	50	50	**100**
				Total					**20**	**31**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

First Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

ME Cycle													Chemistry
S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	ASC	25MAT11	Applied Mathematics for Engineers – I	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25CHE12	Applied Chemistry for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25CHL12	Applied Chemistry Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC -I	25ESC132	Introduction to Electrical Engineering	EEE	3	0	0	0	3	4	50	50	**100**
5	PSC	25MEE143	Elements of Mechanical Engineering	ME	3	0	0	0	3	4	50	50	**100**
6	PSC	25MEL143	Elements of Mechanical Engineering lab	ME	0	0	1	0	1	2	50	50	**100**
7	ESC	25CAD15	Computer Aided Engineering Drawing	ME	2	0	1	0	3	5	50	50	**100**
8	AEC	25ENG16	AI-Powered Communicative English	HSS	0	0	1	0	1	2	50	50	**100**
9	NCMC	25CIP17	Constitution of India and Professional Ethics	HSS	0	0	0	0	PP	1	100	-	**100**
10	AEC	25EDM18	Environment and Disaster Management	AS	1	0	0	0	1	1	50	50	**100**
Total									**20**	**30**	**550**	**450**	**1000**

NEW HORIZON COLLEGE OF ENGINEERING

Second Semester BE-AY 2026-27
Scheme of Teaching and Examinations (2026 -2030 Batch)

ME												Physics Cycle		
S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Tot al
1	ASC	25MAT21	Applied Mathematics for Engineers – II	AS	3	1	0	0	4	5	50	50	**100**
2	ASC	25PHY22	Applied Physics for Engineers	AS	3	0	0	0	3	4	50	50	**100**
3	ASC	25PHL22	Applied Physics Lab for Engineers	AS	0	0	1	0	1	2	50	50	**100**
4	ESC-II	25ESC231	Introduction to Electronics and Communication Engineering	ECE	3	0	0	0	3	4	50	50	**100**
5	PLC	25PLC24	Programming in C	CS	3	0	0	0	3	4	50	50	**100**
6	PLC	25PCL24	Programming in C Lab	CS	0	0	1	0	1	2	50	50	**100**
7	ETC	25ETC25	Introduction to AI and Applications	ME	3	0	0	0	3	4	50	50	**100**
8	AEC	25UHV26	UHV and Indian Ethos	HSS	0	0	0	0	PP	2	100	-	**100**
9	HSS	25KSK27 / 25KBK27	Samskrithika Kannada/ Balake Kannada	HSS	1	0	0	0	1	2	50	50	**100**
10	AEC	25IPL28	Inter-Disciplinary Project Based Learning	AS	0	0	0	1	1	2	50	50	**100**
				Total					**20**	**31**	**550**	**450**	**1000**

COURSE CODE & COURSE NAME

(ESCI/II) Engineering Science Courses I &II		**(PSC) Program specific courses**		**(PSC)Program specific course Lab**	
25ESC131/231	Introduction to Electronics and Communication Engineering	25ECE141	Elements of Electronics and Communication Engineering	25ECL141/241	Elements of Electronics and Communication Engineering Lab
25ESC132/232	Introduction to Electrical Engineering	25EEE142	Elements of Electrical Engineering	25EEL142/242	Elements of Electrical Engineering Lab
25ESC133/233	Introduction to Mechanical Engineering	25MEE143	Elements of Mechanical Engineering	25MEL143/243	Elements of Mechanical Engineering Lab
		25CSE144	Problem Solving Using Python	25CSL144/244	Problem Solving Using Python Lab
(PLC) Programming Language Course		**(PLC) Programming Language Course Lab**		**(ASC) Applied Science Courses**	
25PLC24	Programming in C	25PCL24	Programming in C lab	25MAT11	Applied Mathematics for Engineers I (Stream Specific)
(ETC) Emerging Technology Courses I&II		**(ESC) Engineering Science Course**		25MAT21	Applied Mathematics for Engineers II (Stream Specific)
25ETC15/ 25	Introduction to AI and Applications	25CAD15/25	Computer Aided Engineering Drawing	25PHY12/22	Applied Physics for Engineers (Stream Specific)
(NCMC) Non-Credit Mandatory Courses		**(HSS/AEC) Humanities/ Ability Enhancement Courses**		25CHE12/22	Applied Chemistry for Engineers (Stream Specific)
25UHV16/26	UHV and Indian Ethos	25ENG16/26	AI Powered Communication Skills	**(ASC) Applied Science Course Lab**	
25CIP17/ 27	Constitution of India and Professional Ethics	25KBK17/27	Balake Kannada	25PHL12/22	Applied Physics Lab for Engineers
		25KSK17/27	Samskrutika Kannada/	25CHL12/22	Applied Chemistry Lab for Engineers
		25IPL18/28	Inter Departmental Project Based Learning		
		25EDM18/28	Environment and Disaster Management		

Guidelines for I year BE Scheme

Credit Definition: **1-hour Lecture (L) per week =1Credit** **2-hoursTutorial(T) per week=1Credit** **2-hours Practical / Drawing (P) per week=1Credit**	04-Credit courses are designed for 50 hours of Teaching-Learning Session. 04-Credit (IC) is designed for 40-45 hours' theory and 10-12 hours of practical sessions. 03-Credit courses are designed for 40 hours of Teaching-Learning Session. 02- Credit courses are designed for 25 hours of Teaching-Learning Session. 01-Credit courses are designed for 12-15 hours of Teaching-Learning sessions.
All students admitted to the engineering program have to complete Applied Mathematics-I and Applied Mathematics-II in I and II semesters by selecting the courses prescribed for their stream, viz. ME, EEE or CSE, under the heading Applied Mathematics for Engineers-I and Applied Mathematics for Enginners -II. Those who have completed the physics course under the heading Applied Physics for Engineers in I semester have to select the prescribed stream wise chemistry course under the heading Applied Chemistry for Engineers during II semester.	
Programme Specific Courses (PSC): Programme Specific Courses (PSC) are a set of core courses tailored to a specific branch of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science and Engineering, Electrical Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in the chosen field. Students must select and complete the course from this group that corresponds to their admitted program stream.	
Engineering Sciences Courses-I/II(ESC-I/II): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other stream courses. Students are required to select and complete two courses that do not belong to their admitted program stream. For example, a student admitted to Mechanical Engineering should not select Introduction to Mechanical Engineering but any other two. One course shall be selected under ESC-I and another course under ESC-II. The two courses must be different from the other.	
AICTE Activity Points Requirement for BE/B.Tech. Programs - As per AICTE guidelines in addition to academic requirements, students must earn a specified number of Activity Points to be earned is to be eligible for the award of their degree. • Regular students admitted to a 4-year degree program must earn 100 Activity Points. • Lateral entry students (joining from the second year) must earn 75 Activity Points. • Students transferred from other universities	

directly into the fifth semester must earn 50 Activity Points from the date of entry into college. These Activity Points are non-credit and will not be considered for the SGPA/CGPA or be used for vertical progression. However, they are mandatory for the award of the degree, and the points earned will be reflected on the eighth semester Grade Card. The hours spent on earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including on weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity. If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released.

OBE: Outcome Based Education (Outcome-Based Education is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve stated objectives and outcomes.

CO: Course outcome (Is a statement that clearly describes what and how much or how well the student will know and be able to do after successfully completing the specified course – the essential knowledge, abilities, and attitudes that constitute the basic learning needed by a graduate of the course.

PO: Programme Outcomes (POs are statements about the knowledge, skills and attitudes (attributes) the graduate of a formal engineering program should have. POs deal with the general aspect of graduation for a particular program, and the competencies and expertise a graduate will possess after completion of the program). (Refer POs defined by NBA)

SGPA -Semester Grade Point Average (The performance of a student in a semester is indicated by a number called SGPA)

$$SGPA = \frac{\sum [\text{Course Credits x Grade Points}] \text{ for all the Courses in that semester}}{\sum [\text{Course Credits}] \text{ for all the Courses in that Semester}}$$

CGPA: Cumulative Grade Point Average (which is the sum of the SGPA's of all semesters or that of an academic year)

$$CGPA = \frac{\sum [\text{Course Credits x Grade Points}] \text{ for all Courses excluding those with F grades until that semester.}}{\sum [\text{Course Credits}] \text{ for all Courses excluding those with F grades until that semester.}}$$

Letter Grade and corresponding Grade Points on a typical 10 - Point scale											NCMC	
Level	**Outstanding**	**Excellent**	**Very Good**	**Good**	**Above Average**	**Average**	**Pass**	**Fail**	**Not Eligible**	**Absent**	**Pass**	**Fail**
Grade	**O**	**A+**	**A**	**B+**	**B**	**C**	**P**	**F**	**DX**	**AB**	**PP**	**NP**
Grade Points	10	9	8	7	6	5	4	0	0	0	0	0
Score (Marks) Range %	90-100	80-89	70-79	60-69	50-59	50-54	40-49	0-39	-	-	40-100	0-30

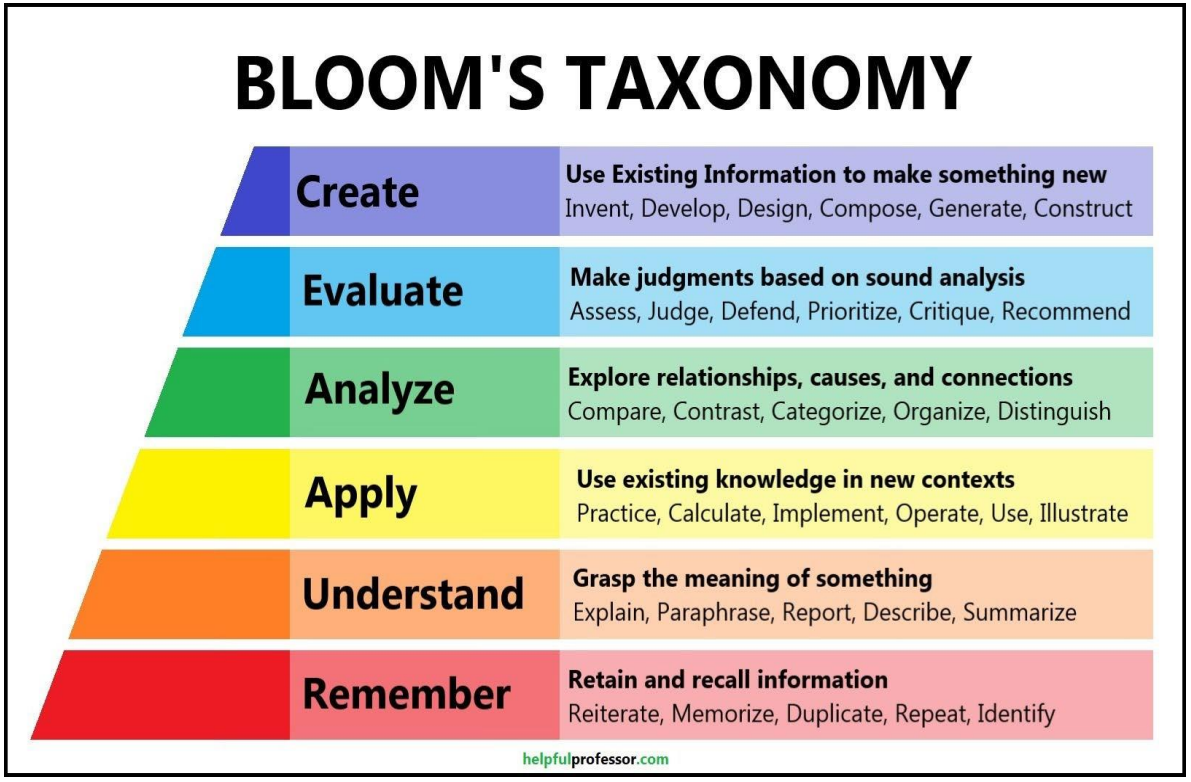
VERTICAL PROGRESSION

Student fails in subjects having more than > 16 credits (backlogs) cannot be promoted to 2year BE

Student can carry any number of credits(backlogs) from 2nd year 3rd year BE

Student should not carry any F/ DX grade of First year BE subjects to go to 4th year BE

RBT	**Revised Blooms Taxonomy Levels** (There are six levels of cognitive learning according to the revised version of Bloom's Taxonomy. Each level is conceptually different. The six levels are- **Remembering(L1), Understanding(L2), Applying(L3), Analyzing(L4), Evaluating(L5), and Creating(L6).**



APPLIED SCIENCE COURSES

APPLIED MATHEMATICS FOR ENGINEERS-I (FOR CSE/AIML)			
Course Code	**25MAT11**	**CIE Marks**	**50**
L:T:P:S	**3:1:0:0**	**SEE Marks**	**50**
Hrs. / Week	**5**	**Total Marks**	**100**
Credits	**4**	**Exam Hours**	**3**

Course outcomes:
At the end of the course, the student will be able to:

CO1	Solve the system of linear equations by applying the ideas of linear algebra.
CO2	Understand the properties of Linear Algebra for network, traffic and electrical circuits analysis.
CO3	Understand the relations between different coordinate systems and its applications in digital gadgets and computer codes.
CO4	Apply multivariable methods for some real problems and estimating the maximum/minimum values for a physical model.
CO5	Apply modular arithmetic knowledge to computer algorithms

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**ELEMENTS OF LINEAR ALGEBRA**	**CO1**	**8L+2T Hours**

Elementary transformations, Reduction of the given matrix to echelon form, Rank of a Matrix, Consistency of a system of linear equations and solution. Solution of a system of linear homogeneous equations (trivial and non- trivial solutions), Solution of a system of non-homogeneous equations by Gauss-Seidel method.

Applications	Consistency in word problems.
Text Book	Text Book 1: 2.7, 2.10, 28.5 Text Book 2: 7.4, 8.1, 8.4 Text Book 3: 1.2.5, 1.2.6, 1.6.1

MODULE-2	**APPLIED LINEAR ALGEBRA AND ITS PROPERTIES**	**CO2**	**8L+2T Hours**

Eigen values and Eigen vectors of a square matrix and its standard properties, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector, Power of matrices using Diagonalization. Solutions of homogeneous linear differential equation using matrix method.

Applications	Traffic, Network flow and Electrical circuit problems.
Text Book	Text Book 1: 2.13, 28.9, 2.16 Text Book 2: 7.9, 8.1, 8.4 Text Book 3: 1.4.2, 1.5.1, 1.6.1

MODULE-3	**DIFFERENTIAL CALCULUS**	**CO3**	**8L+2T Hours**

Importance of cartesian and polar coordinate system: Angle between the radius vector and tangent (Derivation and problems), angle between two curves, Pedal equation for polar curves.
Curvature and radius of curvature: Cartesian, Parametric, Polar and Pedal forms.

Applications	Centre of Curvature at any point $P(x, y)$ on the curve $y = f(x)$ and Evolute.
Text Book	Text Book 1: 4.6, 4.7, 4.8, 4.11

MODULE-4	**MULTIVARIABLE DERIVATIVES**	**CO4**	**8L+2T Hours**

Existence of multivariable in real problems leading to partial derivatives understanding partial differentiation, Total differentiation, Homogeneous function Euler's Theorem, Taylors and Maclaurin's series for one and two variables, Extreme values of the function and Jacobians.

Applications	Strength of a beam with relative changes, Transformation from one coordinate system to another.
Text Book	Text Book 1: 5.2, 5.4, 5.5, 5.7, 5.9, 5.11

MODULE-5	**MODULAR ARITHMETIC-1**	**CO5**	**8L+2T Hours**

Finding GCD, Introduction to Congruences, Linear Congruences, Linear Diophantine equation, System of Linear Congruences. The Chinese Remainder theorem.

Applications	Error detection and correction.

Text Book	TextBook 4	
List of Tutorial Contents		
Sl. No.	**Contents**	**COs**
1.	Consistency in word problems.	CO1
2.	Inconsistency in word problems.	CO1
3.	Traffic, Network flow problems.	CO2
4.	Electrical circuit problems.	CO2
5.	Coordinates of the Centre of Curvature.	CO3
6.	Evolute of a curve.	CO3
7.	Strength of a beam problem.	CO4
8.	Transformation from one coordinate system to another system problems.	CO4
9.	Linear Diophantine equation.	CO5
10.	Error detection and correction.	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Theory Tests	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	5
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources: Text Books:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.
3) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2016, ISBN: 9789332575288.
4) M.K.Pathak, S.Ramasamy, Modular Arithmetics, Campus Books International, 2012 Edition, ISBN: 9788180303463.

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2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

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2) https://youtu.be/p8XcOigHZoo?si=ueuQaQh4iMb1fi2_
3) https://youtu.be/JV0hjyI4Erg?si=X9xFpzvscqsyheYh
4) https://youtu.be/bTs7ncA_AtY
5) https://youtu.be/HEAokut4F4I

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
- Problem solving Approach.
- Organizing Group wise discussions on related topics
- Seminars

APPLIED MATHEMATICS FOR ENGINEERS-I (FOR ECE/EEE/ME)			
Course Code	**25MAT11**	**CIE Marks**	**50**
L:T:P:S	**3:1:0:0**	**SEE Marks**	**50**
Hrs. / Week	**5**	**Total Marks**	**100**
Credits	**4**	**Exam Hours**	**3**

Course outcomes:
At the end of the course, the student will be able to:

CO1	Solve the system of linear equations by applying the ideas of linear algebra.
CO2	Understand the properties of Linear Algebra for network, traffic and electrical circuits analysis.
CO3	Understand the relations between different coordinate systems and its applications in digital gadgets and computer codes.
CO4	Apply multivariable methods for some real problems and estimating the maximum/minimum values for a physical model.
CO5	Apply the concept of vector calculus for solving engineering problems

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

MODULE-1	**ELEMENTS OF LINEAR ALGEBRA**	**CO1**	**8L+2T Hours**

Elementary transformations, Reduction of the given matrix to echelon form, Rank of a Matrix, Consistency of a system of linear equations and solution. Solution of a system of linear homogeneous equations (trivial and non- trivial solutions), Solution of a system of non-homogeneous equations by Gauss-Seidel method.

Applications	Consistency in word problems.
Text Book	Text Book 1: 2.7, 2.10, 28.5 Text Book 2: 7.4, 8.1, 8.4 Text Book 3: 1.2.5, 1.2.6, 1.6.1

MODULE-2	**APPLIED LINEAR ALGEBRA AND ITS PROPERTIES**	**CO2**	**8L+2T Hours**

Eigen values and Eigen vectors of a square matrix and its standard properties, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector, Power of matrices using Diagonalization. Solutions of homogeneous linear differential equation using matrix method.

Applications	Traffic, Network flow and Electrical circuit problems.
Text Book	Text Book 1: 2.13, 28.9, 2.16 Text Book 2: 7.9, 8.1, 8.4 Text Book 3: 1.4.2, 1.5.1, 1.6.1

MODULE-3	**DIFFERENTIAL CALCULUS**	**CO3**	**8L+2T Hours**

Importance of cartesian and polar coordinate system: Angle between the radius vector and tangent (Derivation and problems), angle between two curves, Pedal equation for polar curves. Curvature and radius of curvature: Cartesian, Parametric, Polar and Pedal forms.

Applications	Centre of Curvature at any point $P(x, y)$ on the curve $y = f(x)$ and Evolute.
Text Book	Text Book 1: 4.6, 4.7, 4.8, 4.11

MODULE-4	**MULTIVARIABLE DERIVATIVES**	**CO4**	**8L+2T Hours**

Existence of multivariable in real problems leading to partial derivatives understanding partial differentiation, Total differentiation, Homogeneous function Euler's Theorem, Taylors and Maclaurin's series for one and two variables, Extreme values of the function and Jacobians.

Applications	Strength of a beam with relative changes, Transformation from one coordinate system to another.
Text Book	Text Book 1: 5.2, 5.4, 5.5, 5.7, 5.9, 5.11

MODULE-5	**VECTOR CALCULUS**	**CO5**	**8L+2T Hours**

Velocity and Acceleration, Gradient, Divergence, Curl, Laplacian-physical significance and problems. Solenoidal and Irrotational vector fields. Vector identities.

Applications	Special Curvilinear systems: Cylindrical Coordinates and Spherical Polar Coordinates, work done, Potential field, conservative field.
Text Book	Text Book 1: 8.3, 8.5, 8.7, 8.18 Text Book 2: 9.7, 9.8, 9.9 Text Book 3: 3.2, 3.3

List of Tutorial Contents

Sl. No.	Contents	COs
1.	Consistency in word problems.	CO1
2.	Inconsistency in word problems.	CO1
3.	Traffic, Network flow problems.	CO2
4.	Electrical circuit problems.	CO2
5.	Coordinates of the Centre of Curvature.	CO3
6.	Evolute of a curve.	CO3
7.	Strength of a beam problem.	CO4
8.	Transformation from one coordinate system to another system problems.	CO4
9.	Cylindrical Coordinates system problems.	CO5
10.	Spherical Polar Coordinates system problems.	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Theory Tests	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	5
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

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2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

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3) https://youtu.be/JV0hjyI4Erg?si=X9xFpzvscqsyheYh
4) https://youtu.be/bTs7ncA_AtY
5) https://youtu.be/HEAokut4F4I

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
  - Problem solving Approach.
  - Organizing Group wise discussions on related topics
  - Seminars

APPLIED MATHEMATICS FOR ENGINEERS-II (FOR CSE/AIML)			
Course Code	**25MAT21**	**CIE Marks**	**50**
L:T:P:S	**3:1:0:0**	**SEE Marks**	**50**
Hrs. / Week	**5**	**Total Marks**	**100**
Credits	**4**	**Exam Hours**	**3**

Course outcomes:
At the end of the course, the student will be able to:

CO1	Find an approximate curve for a real practical problem using least square method.
CO2	Apply to find the solution for LCR and Newton's law of cooling.
CO3	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.
CO4	Analyse the continuous/discontinuous/periodic and its initial value problems.
C05	Apply modular arithmetic knowledge to computer algorithms.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	
CO1	3	2	-	-	-	-	-	-	-	-	-	
CO2	3	2	-	-	-	-	-	-	-	-	-	
CO3	3	2	-	-	-	-	-	-	-	-	-	
CO4	3	2	-	-	-	-	-	-	-	-	-	
C05	3	2	-	-	-	-	-	-	-	-	-	

MODULE-1	**STATISTICAL ANALYSIS**	**CO1**	**8L+2T Hours**

Fitting of the curves of linear, quadratic, exponential and geometric curves by least square method. Correlation, Coefficient of correlation and Lines of Regression and Co-efficient of correlation.

Applications	Data analysis for real problem, mean and variance.
Text Book	Text Book 1: 24.5, 25.12, 25.13, 25.14

MODULE-2	**ORDINARY DIFFERENTIAL EQUATIONS**	**CO2**	**8L+2T Hours**

First order and First degree: Exact, Reducible to exact. Solutions for second and higher order linear ordinary differential equation: Homogeneous and standard non- homogeneous functions. Solution of Legendre's linear differential equation. Solution of initial and boundary value problems.

Applications	Newton's law of cooling, LCR circuits and population model.
Text Book	Text Book 1: 11.11, 11.12, 13.5 Text Book 2: 1.4

MODULE-3	**MULTIPLE INTEGRALS**	**CO3**	**8L+2T Hours**

Evaluation of double integrals, evaluation of double integrals by change of order of integration, double integrals by changing into polar coordinates, Area enclosed by plane curves, Evaluation of triple integrals, Volume of solids.

Applications	Change of Variables and Area of a circle, ellipse, cardioid and volume of sphere, cylinder and Trapezium.
Text Book	Text Book 1: 7.1, 7.2, 7.3.

MODULE-4	**LAPLACE AND INVERSE LAPLACE TRANSFORMS**	**CO4**	**8L+2T Hours**

Definition and Laplace transforms of standard functions. Properties of Laplace transforms: Shifting properties, Multiplication by t^n, Division by t. Periodic functions, unit-step function. Inverse Laplace Transform. Solution of differential equations.

Applications	Handling continuous/discontinuous functions, electrical circuits, bridges/beams, Earthquake, Shockwaves and Thermodynamic problems.
Text Book	Text Book 1: 21.2, 21.4, 21.5, 21.9, 21.10, 21.12, 21.15 Text Book 3: 5.2, 5.3.1, 5.3.2, 5.5.6

MODULE-5	**MODULAR ARITHMETIC-2**	**CO5**	**8L+2T Hours**

Euler's theorem, Wilson theorem and Fermat's little theorem, Solving Polynomials, RSA algorithm, Cryptography, Encoding and Decoding.

Applications	RSA applications in public key encryption.
Text Book	Text Book 4

List of Tutorial Contents

Sl. No.	Contents	COs
1.	Standard error of estimate.	CO1
2.	Problems on rank correlation.	CO1
3.	Newton's law of cooling, LCR circuit problems.	CO2
4.	Solution of initial and boundary value problems.	CO2
5.	Change of Variables	CO3
6.	Area of a curved surface.	CO3
7.	Solution of continuous/discontinuous functions, electrical circuits, bridges/beams.	CO4
8.	Solution of linear differential equations.	CO4
9.	Encoding and Decoding problems.	CO5
10.	RSA applications in public key encryption.	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Theory Tests	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	5
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

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Text Books:

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3) https://youtu.be/JV0hjyI4Erg?si=X9xFpzvscqsyheYh
4) https://youtu.be/bTs7ncA_AtY
5) https://youtu.be/HEAokut4F4I

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- Organizing Group wise discussions on related topics
- Seminars

APPLIED MATHEMATICS FOR ENGINEERS-II (FOR ECE/EEE/ME)			
Course Code	**25MAT21**	**CIE Marks**	**50**
L:T:P:S	**3:1:0:0**	**SEE Marks**	**50**
Hrs. / Week	**5**	**Total Marks**	**100**
Credits	**4**	**Exam Hours**	**3**

Course outcomes:
At the end of the course, the student will be able to:

CO1	Find an approximate curve for a real practical problem using least square method.
CO2	Apply to find the solution for LCR and Newton's law of cooling.
CO3	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.
CO4	Analyse the continuous/discontinuous/periodic and its initial value problems.
CO5	Apply partial differential equation techniques to solve Engineering problems.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**STATISTICAL ANALYSIS**	**CO1**	**8L+2T Hours**
Fitting of the curves of linear, quadratic, exponential and geometric curves by least square method. Correlation, Coefficient of correlation and Lines of Regression and Co-efficient of correlation.			
Applications	Data analysis for real problem, mean and variance.		
Text Book	Text Book 1: 24.5, 25.12, 25.13, 25.14		
MODULE-2	**ORDINARY DIFFERENTIAL EQUATIONS**	**CO2**	**8L+2T Hours**
First order and First degree: Exact, Reducible to exact. Solutions for second and higher order linear ordinary differential equation: Homogeneous and standard non- homogeneous functions. Solution of Legendre's linear differential equation. Solution of initial and boundary value problems.			
Applications	Newton's law of cooling, LCR circuits and population model.		
Text Book	Text Book 1: 11.11, 11.12, 13.5 Text Book 2: 1.4		
MODULE-3	**MULTIPLE INTEGRALS**	**CO3**	**8L+2T Hours**
Evaluation of double integrals, evaluation of double integrals by change of order of integration, double integrals by changing into polar coordinates, Area enclosed by plane curves, Evaluation of triple integrals, Volume of solids.			
Applications	Change of Variables and Area of a circle, ellipse, cardioid and volume of sphere, cylinder and Trapezium.		
Text Book	Text Book 1: 7.1, 7.2, 7.3.		
MODULE-4	**LAPLACE AND INVERSE LAPLACE TRANSFORMS**	**CO4**	**8L+2T Hours**
Definition and Laplace transform of standard functions. Properties of Laplace transforms: Shifting properties, Multiplication by t^n, Division by t. Periodic functions, unit-step function. Inverse Laplace Transform. Solution of differential equations.			
Applications	Handling continuous/discontinuous functions, electrical circuits, bridges/beams, Earthquake, Shockwaves and Thermodynamic problems.		
Text Book	Text Book 1: 21.2, 21.4, 21.5, 21.9, 21.10, 21.12, 21.15 Text Book 3: 5.2, 5.3.1, 5.3.2, 5.5.6		
MODULE-5	**PARTIAL DIFFERENTIAL EQUATIONS**	**CO5**	**8L+2T Hours**
Formation of partial differential equation by eliminating arbitrary constants and functions**.** Solution of Lagrange's partial differential equation, Solution of Partial differential equation by separation of variables method, Derivation of one-dimensional heat and wave equations.			
Applications	Solution of one-dimensional heat, wave and two-dimensional Laplace equation.		
Text Book	Text Book 1: 17.2, 17.5, 18.2, 18.4, 18.5, 18.7 Text Book 2: 12.2, 12.5, 12.11		

List of Tutorial Contents		
Sl. No.	**Contents**	**COs**
1.	Standard error of estimate.	CO1
2.	Problems on rank correlation.	CO1
3.	Newton's law of cooling, LCR circuit problems.	CO2
4.	Solution of initial and boundary value problems.	CO2
5.	Change of Variables	CO3
6.	Area of a curved surface.	CO3
7.	Solution of continuous/discontinuous functions, electrical circuits, bridges/beams.	CO4
8.	Solution of linear differential equations.	CO4
9.	Derive one-dimensional heat, wave equations by separation of variables method.	CO5
10.	Derive two-dimensional Laplace equation by separation of variables method.	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Theory Tests	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	5
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.
3) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2016, ISBN: 9789332575288.
4) M.K.Pathak, S.Ramasamy, Modular Arithmetics, Campus Books International, 2012 Edition, ISBN: 9788180303463.

Reference Books:

1) David C Lay, Linear Algebra and its applications, Addison-Wesley Publishers, Fourth Edition, 2012, ISBN: 9780321385178.
2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

1) https://youtu.be/kAa5ReiZH6o
2) https://youtu.be/hiNbVgSye-o
3) https://youtu.be/BJ_0FURo9RE
4) https://youtu.be/4Mr7aEHQr8E
5) https://youtu.be/hcm-CgHFbwI

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
- Problem solving Approach
- Organizing Group wise discussions on related topics
- Seminars

APPLIED CHEMISTRY FOR ENGINEERS (For CSE/AIML)			
Course Code	**25CHE12/22**	**CIE Marks**	**50**
L: T : P :S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**4**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	**A**nalyze the functioning of energy storage systems, corrosion mechanisms, and sensor technologies using fundamental electrochemical principles.
CO2	Implement chemical techniques to control pollution and promote sustainability by understanding the environmental impact of industrial processes.
CO3	Apply knowledge of advanced materials in energy storage, display systems, and environmental monitoring.
CO4	Develop problem-solving skills through numerical problems, design challenges, and applications in electrochemistry, corrosion science, and nanotechnology.
CO5	Understand the basics principles and applications of functional materials for sustainable technological development.

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	-	-	-
CO3	3	2	-	-	-	2	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	2	-	-	-	-	-

MODULE-1	**Energy Conversion and Storage**	**CO1,CO3 CO4,CO5**	**8 Hours**

Fundamentals of Electrochemistry: Gibb's free energy, Single electrode potential, Galvanic cell, EMF, Reference electrode.

Derivation of Nernst equation and Numerical. Concentration cell and numericals.

Batteries: Introduction, classification, characteristics. Construction, working and applications of Zn- air and Li - ion battery

Fuel cell -Definition and classification. Construction, working and applications of solid oxide fuel cell (SOFC)

Photo Voltaic Cells – Introduction. Construction and working of silicon solar cell and Dye-sensitized solar cell, Advantages and disadvantages of PV cells

Super Capacitors: Introduction and classification. Construction, working and applications of electro chemical double layer capacitors.

Textbooks	**1&2**

MODULE-2	**Corrosion Science Engineering**	**CO1,CO3 CO4,CO5**	**8 Hours**

Corrosion Science: Electrochemical theory of corrosion. Types of corrosion - differential metal, differential aeration corrosion (pitting and waterline) and stress corrosion Caustic embrittlement. Factors influencing rate of corrosion- Nature of the metal, Relative anodic and cathodic areas and Nature of the corrosion product, selection and design of materials. Corrosion penetration rate (CPR) - Introduction and numerical problem.

Corrosion control techniques: – protective coatings – metal coatings (Anodic and Cathodic metal coatings taking Galvanization and Tinning as example). Inorganic coatings - Anodizing of aluminium. Cathodic protection by sacrificial anodic method and Impressed voltage method.

Metal Finishing - Introduction and technological importance.

Electro plating: Introduction. Chromium plating and its applications.

Electroless plating: Introduction, double sided PCB making using copper electro less plating.

Textbooks	**1&2**

MODULE-3	**Nano Materials, Display Systems and Analytical techniques**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Nanomaterials: Introduction, Size dependent properties. Classification based on dimensions (0D, 1D, 2D and 3D. Bottom up and top-down approach of nano material synthesis, Synthesis and applications of copper oxide nanoparticles by co-precipitation method, carbon nano tubes (CNTs) by chemical vapor deposition. Applications of gold nano particles for cancer treatment.

Display systems: Liquid crystals - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). LED display system working and applications. OLED display system working and applications. QLED display system working and applications.

Analytical Techniques: Introduction. Principle, instrumentation and applications of UV-Visible spectrophotometry and conductometry.

Textbooks	**3&4**

MODULE-4	**Advanced Methods for Air and Water Treatment**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Air pollution Management: Introduction to Primary and Secondary Air Pollutants, Selective catalytic reduction of NOx, Chemical capturing of carbon dioxide, Electrostatic precipitation technique for the removal of particulate matter and smoke in mining industries.

Water treatment: Determination of chemical oxygen demand of Industry wastewater sample, problems on it. Sewage treatment - primary and secondary methods. Softening of water by ion exchange method. Desalination of sea water by electro-dialysis. Construction and working of domestic water purifier. Role of reverse osmosis process in water purification. Photo catalytic dye degradation in water by TiO_2 nano particles.

Textbooks	**5**

MODULE-5	**Chemical Sensors and E-Waste Management:**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Chemical Sensors: Definition and significance. Classification of Chemical Sensors based on transduction principle and
Chemical Sensors: Definition and significance. Classification of Chemical Sensors based on transduction principle and
analyte type. Basic Components of Chemical Sensors.

Electrochemical Sensors: Introduction and types**.** Construction and working of pH sensor.

Optical Sensors: Introduction and types. Construction and working of Flame photometer.

Applications of chemical sensors in Environmental monitoring (DO sensor). Medical diagnostics (Glucose sensor).

E-Waste Management:

Introduction, sources of e-waste, composition, characteristics, and need of e-waste management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste.

Metal Recovery from E-Waste -Steps involved Extraction of gold from E-waste. Li - ion battery recycling.

Textbooks	**6&7**

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test(s)	Alternate Assessment
		25	25
L1	Remember	5	-
L2	Understand	10	10
L3	Apply	5	10
L4	Analyze	5	5
L5	Evaluate		
L6	Create		

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Textbooks

1. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & PushpaIyengar., Subash Publications, 5th Edition, 2014
2. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996, ISBN: 0-07-100360-6.
3. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005
4. Display Systems: Design and Applcations, 1st edition, Wiley India Pvt Ltd, New Delhi. ISBN:0-471-95870-0
5. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition. 20.11.2022
6. Engineering Chemistry (As Per Revised VTU Syllabus, 2022-2023), ISBN: 9788196001834
7. A Textbook of Engineering Chemistry, Shashi Chawla, Danpat Rai prakashan.

Reference Books

8. OLED Display Fundamentals and Applications, TakatoshiTsujimura, Wiley–Blackwell, 2012.
9. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
10. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
11. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
12. E-wastemanagement: Challenges and opportunities in India, Varsha Bhagat- Ganguly, Taylor and Francis, 2021, ISBN:13:978-0367249984.

WEBLINKS

a. https://youtu.be/G5McJw4KkG8 - Li-ion battery working
b. https://youtu.be/PilpTDYtyIc - Construction and working of SOFC fuel cell
c. https://youtu.be/g1TfQ9rypHI- Construction and working of dye sensitized cell
d. https://www.youtube.com/watch?v=0yl35W0o9S0&t=118s - Anodizing of Al
e. https://www.youtube.com/watch?v=iLgiTAz86Hw - Cr plating
f. https://youtu.be/Ukc_kc5OAhw - PCB making
g. https://youtu.be/JtdCLPOcz5Y - CuO synthesis
h. https://youtu.be/xAMhX3Drq14 - OLED working
i. https://youtu.be/aVdWqbpbv_Y - Working of reverse osmosis

Activity-Based Learning (Suggested Activities in Class)/ Practical Based Learning

Video Demonstrations of battery and fuel cell working, Experiential learning in the laboratory,

Flowcharts and Handout preparation by students, Group Discussion, Seminars

APPLIED CHEMISTRY FOR ENGINEERS
(For ECE&EEE)

Course Code	**25CHE12/22**	**CIE Marks**	**50**
L: T : P :S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**4**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	**A**nalyze the functioning of energy storage systems, corrosion mechanisms, and sensor technologies using fundamental electrochemical principles.
CO2	Implement chemical techniques to control pollution and promote sustainability by understanding the environmental impact of industrial processes.
CO3	Apply knowledge of advanced materials in energy storage, display systems, and environmental monitoring.
CO4	Develop problem-solving skills through numerical problems, design challenges, and applications in electrochemistry, corrosion science, and nanotechnology.
CO5	Understand the basics principles and applications of functional materials for sustainable technological development.

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	-	-	-
CO3	3	2	-	-	-	2	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	2	-	-	-	-	-

MODULE-1	**Energy Conversion and Storage**	**CO1,CO3 CO4,CO5**	**8 Hours**

Fundamentals of Electrochemistry: Gibb's free energy, Single electrode potential, Galvanic cell, EMF, Reference electrode.

Derivation of Nernst equation and Numerical. Concentration cell and numericals.

Batteries: Introduction, classification, characteristics. Construction, working and applications of Zn- air and Li -ion battery

Fuel cell -Definition and classification. Construction, working and applications of solid oxide fuel cell (SOFC)

Photo Voltaic Cells – Introduction. Construction and working of silicon solar cell and Dye-sensitized solar cell, Advantages and disadvantages of PV cells

Super Capacitors: Introduction and classification. Construction, working and applications of electro chemical double layer capacitors.

Textbooks	**1&2**

MODULE-2	**Corrosion Science Engineering**	**CO1,CO3 CO4,CO5**	**8 Hours**

Corrosion Science: Electrochemical theory of corrosion. Types of corrosion - differential metal, differential aeration corrosion (pitting and waterline) and stress corrosion Caustic embrittlement. Factors influencing rate of corrosion-Nature of the metal, Relative anodic and cathodic areas and Nature of the corrosion product, selection and design of materials. Corrosion penetration rate (CPR) - Introduction and numerical problem.

Corrosion control techniques: – protective coatings – metal coatings (Anodic and Cathodic metal coatings taking Galvanization and Tinning as example). Inorganic coatings - Anodizing of aluminium. Cathodic protection by sacrificial anodic method and Impressed voltage method.

Metal Finishing - Introduction and technological importance.

Electro plating: Introduction. Chromium plating and its applications.

Electroless plating: Introduction, double sided PCB making using copper electro less plating.

Textbooks	**1&2**

MODULE-3	**Nano Materials, Display Systems and Analytical techniques**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Nanomaterials: Introduction, Size dependent properties. Classification based on dimensions (0D, 1D, 2D and 3D. Bottom up and top-down approach of nano material synthesis, Synthesis and applications of copper oxide nanoparticles by co-precipitation method, carbon nano tubes (CNTs) by chemical vapor deposition. Applications of gold nano particles for cancer treatment.

Display systems: Liquid crystals - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). LED display system working and applications. OLED display system working and applications. QLED display system working and applications.

Analytical Techniques: Introduction. Principle, instrumentation and applications of UV-Visible spectrophotometry and conductometry.

Textbooks	**3&4**

MODULE-4	**Advanced Methods for Air and Water Treatment**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Air pollution Management: Introduction to Primary and Secondary Air Pollutants, Selective catalytic reduction of NOx, Chemical capturing of carbon dioxide, Electrostatic precipitation technique for the removal of particulate matter and smoke in mining industries.

Water treatment: Determination of chemical oxygen demand of Industry wastewater sample, problems on it. Sewage treatment - primary and secondary methods. Softening of water by ion exchange method. Desalination of sea water by electro-dialysis. Construction and working of domestic water purifier. Role of reverse osmosis process in water purification. Photo catalytic dye degradation in water by TiO_2 nano particles.

Textbooks	**5**

MODULE-5	**Chemistry of Electronic Materials and Chemical Sensors.**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Chemistry of Electronic Materials

Silicon as semiconductor and its applications. Production of solar grade silicon by Union carbide process and Zone refining. Synthesis of electronic grade silicon by Czochralski process (CZ).

Polymers for Electrical and Electronic Applications:

Conducting polymers: Synthesis and conducting mechanism of poly acetylene, Poly aniline and applications

Insulating Polymers: Synthesis and applications of PVC and Teflon

Chemical Sensors: Definition and significance. Classification of Chemical Sensors based on transduction principle and analyte type. Basic Components of Chemical Sensors.

Electrochemical Sensors: Introduction and types**.** Construction and working of pH sensor.

Optical Sensors: Introduction and types. Construction and working of Flame photometer.

Applications of chemical sensors in Environmental monitoring (DO sensor). Medical diagnostics (Glucose sensor).

Textbooks	**6&7**

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test(s)	Alternate Assessment
		25	25
L1	Remember	5	-
L2	Understand	10	10
L3	Apply	5	10
L4	Analyze	5	5
L5	Evaluate		
L6	Create		

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Textbooks

1. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & PushpaIyengar., Subash Publications, 5th Edition, 2014
2. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996, ISBN: 0-07-100360-6.
3. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005
4. Display Systems: Design and Applcations, 1st edition, Wiley India Pvt Ltd, New Delhi. ISBN:0-471-95870-0
5. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition. 20.11.2022
6. Engineering Chemistry (As Per Revised VTU Syllabus, 2022-2023), ISBN: 9788196001834
7. A Textbook of Engineering Chemistry, Shashi Chawla, Danpat Rai prakashan.

Reference Books

8. OLED Display Fundamentals and Applications, TakatoshiTsujimura, Wiley–Blackwell, 2012.
9. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
10. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
11. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
12. E-wastemanagement: Challenges and opportunities in India, Varsha Bhagat- Ganguly, Taylor and Francis, 2021, ISBN:13:978-0367249984.

WEBLINKS

a. https://youtu.be/G5McJw4KkG8 - Li-ion battery working
b. https://youtu.be/PilpTDYtyIc - Construction and working of SOFC fuel cell
c. https://youtu.be/g1TfQ9rypHI- Construction and working of dye sensitized cell
d. https://www.youtube.com/watch?v=0yl35W0o9S0&t=118s - Anodizing of Al
e. https://www.youtube.com/watch?v=iLgiTAz86Hw - Cr plating
f. https://youtu.be/Ukc_kc5OAhw - PCB making
g. https://youtu.be/JtdCLPOcz5Y - CuO synthesis
h. https://youtu.be/xAMhX3Drq14 - OLED working
i. https://youtu.be/aVdWqbpbv_Y - Working of reverse osmosis

Activity-Based Learning (Suggested Activities in Class)/ Practical Based Learning

Video Demonstrations of battery and fuel cell working, Experiential learning in the laboratory,

Flowcharts and Handout preparation by students, Group Discussion, Seminars

APPLIED CHEMISTRY FOR ENGINEERS (For ME)			
Course Code	**25CHE12/22**	**CIE Marks**	**50**
L: T : P :S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**4**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	**A**nalyze the functioning of energy storage systems, corrosion mechanisms, and sensor technologies using fundamental electrochemical principles.
CO2	Implement chemical techniques to control pollution and promote sustainability by understanding the environmental impact of industrial processes.
CO3	Apply knowledge of advanced materials in energy storage, display systems, and environmental monitoring.
CO4	Develop problem-solving skills through numerical problems, design challenges, and applications in electrochemistry, corrosion science, and nanotechnology.
CO5	Understand the basics principles and applications of functional materials for sustainable technological development.

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	-	-	-
CO3	3	2	-	-	-	2	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	2	-	-	-	-	-

MODULE-1	**Energy Conversion and Storage**	**CO1,CO3 CO4,CO5**	**8 Hours**

Fundamentals of Electrochemistry: Gibb's free energy, Single electrode potential, Galvanic cell, EMF, Reference electrode.

Derivation of Nernst equation and Numerical. Concentration cell and numericals.

Batteries: Introduction, classification, characteristics. Construction, working and applications of Zn- air and Li -ion battery

Fuel cell -Definition and classification. Construction, working and applications of solid oxide fuel cell (SOFC)

Photo Voltaic Cells – Introduction. Construction and working of silicon solar cell and Dye-sensitized solar cell, Advantages and disadvantages of PV cells

Super Capacitors: Introduction and classification. Construction, working and applications of electro chemical double layer capacitors.

Textbooks	**1&2**

MODULE-2	**Corrosion Science Engineering**	**CO1,CO3 CO4,CO5**	**8 Hours**

Corrosion Science: Electrochemical theory of corrosion. Types of corrosion - differential metal, differential aeration corrosion (pitting and waterline) and stress corrosion Caustic embrittlement. Factors influencing rate of corrosion- Nature of the metal, Relative anodic and cathodic areas and Nature of the corrosion product, selection and design of materials. Corrosion penetration rate (CPR) - Introduction and numerical problem.

Corrosion control techniques: – protective coatings – metal coatings (Anodic and Cathodic metal coatings taking Galvanization and Tinning as example). Inorganic coatings - Anodizing of aluminium. Cathodic protection by sacrificial anodic method and Impressed voltage method.

Metal Finishing - Introduction and technological importance.

Electro plating: Introduction. Chromium plating and its applications.

Electroless plating: Introduction, double sided PCB making using copper electro less plating.

Textbooks	**1&2**

MODULE-3	**Nano Materials, Display Systems and Analytical techniques**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Nanomaterials: Introduction, Size dependent properties. Classification based on dimensions (0D, 1D, 2D and 3D. Bottom up and top-down approach of nano material synthesis, Synthesis and applications of copper oxide nanoparticles by co-precipitation method, carbon nano tubes (CNTs) by chemical vapor deposition. Applications of gold nano particles for cancer treatment.

Display systems: Liquid crystals - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). LED display system working and applications. OLED display system working and applications. QLED display system working and applications.

Analytical Techniques: Introduction. Principle, instrumentation and applications of UV-Visible spectrophotometry and conductometry.

Textbooks	**3&4**

MODULE-4	**Advanced Methods for Air and Water Treatment**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Air pollution Management: Introduction to Primary and Secondary Air Pollutants, Selective catalytic reduction of NOx, Chemical capturing of carbon dioxide, Electrostatic precipitation technique for the removal of particulate matter and smoke in mining industries.

Water treatment: Determination of chemical oxygen demand of Industry wastewater sample, problems on it. Sewage treatment - primary and secondary methods. Softening of water by ion exchange method. Desalination of sea water by electro-dialysis. Construction and working of domestic water purifier. Role of reverse osmosis process in water purification. Photo catalytic dye degradation in water by TiO_2 nano particles.

Textbooks	**5**

MODULE-5	**Materials for Mechanical Engineering Applications and Chemistry of Fuels**	**CO1,CO2 CO3,CO4 CO5**	**8 Hours**

Materials for Mechanical Engineering Applications

Alloys: Introduction, classification, composition, properties and applications of Stainless Steel, Brass and Alnico.

Ceramics: Introduction, classification based on chemical composition, properties and applications of perovskites($CaTiO_3$).

Polymers: Introduction, methods of polymerization (condensation and free radical),

Introduction, Synthesis, properties and industrial applications of **polyvinylchloride** (PVC) and **Teflon.**

Chemistry of Fuels

Introduction to chemical fuels and classification.

Properties of fuels: Calorific value (GCV and NCV), Octane and Cetane number. Determination of calorific value of fuel using Bomb calorimeter- Numerical problems. knocking in IC engine and its mechanism. Anti-knocking agents. Unleaded petrol. Bio diesel - synthesis, properties and applications. Power alcohol- synthesis, properties and applications

Textbooks	**6&7**

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test(s)	Alternate Assessment
		25	25
L1	Remember	5	-
L2	Understand	10	10
L3	Apply	5	10
L4	Analyze	5	5
L5	Evaluate		
L6	Create		

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Textbooks

1. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & PushpaIyengar., Subash Publications, 5th Edition, 2014
2. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996, ISBN: 0-07-100360-6.
3. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005
4. Display Systems: Design and Applcations, 1st edition, Wiley India Pvt Ltd, New Delhi. ISBN:0-471-95870-0
5. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition. 20.11.2022
6. Engineering Chemistry (As Per Revised VTU Syllabus, 2022-2023), ISBN: 9788196001834
7. A Textbook of Engineering Chemistry, Shashi Chawla, Danpat Rai prakashan.

Reference Books

8. OLED Display Fundamentals and Applications, TakatoshiTsujimura, Wiley–Blackwell, 2012.
9. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
10. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
11. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
12. E-wastemanagement: Challenges and opportunities in India, Varsha Bhagat- Ganguly, Taylor and Francis, 2021, ISBN:13:978-0367249984.

WEBLINKS

a. https://youtu.be/G5McJw4KkG8 - Li-ion battery working
b. https://youtu.be/PilpTDYtyIc - Construction and working of SOFC fuel cell
c. https://youtu.be/g1TfQ9rypHI- Construction and working of dye sensitized cell
d. https://www.youtube.com/watch?v=0yl35W0o9S0&t=118s - Anodizing of Al
e. https://www.youtube.com/watch?v=iLgiTAz86Hw - Cr plating
f. https://youtu.be/Ukc_kc5OAhw - PCB making
g. https://youtu.be/JtdCLPOcz5Y - CuO synthesis
h. https://youtu.be/xAMhX3Drq14 - OLED working
i. https://youtu.be/aVdWqbpbv_Y - Working of reverse osmosis

Activity-Based Learning (Suggested Activities in Class)/ Practical Based Learning

Video Demonstrations of battery and fuel cell working, Experiential learning in the laboratory,

Flowcharts and Handout preparation by students, Group Discussion, Seminars

APPLIED CHEMISTRY LAB FOR ENGINEERS (Common for all streams)			
Course Code	**25CHL12/22**	**CIE Marks**	**50**
L: T : P :S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	Perform quantitative estimations and analyses using electrochemical, optical, and volumetric techniques.
CO2	Determine key water quality parameters and interpret their environmental significance.
CO3	Synthesize and characterize nanomaterials and other compounds using modern chemical techniques.
CO4	Work effectively in teams and design open-ended experiments to analyze and compare chemical properties of various samples.

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	2	-	-	-	-
CO3	-	-	**1**	-	1	-	-	-	-	-	-
CO4	-	-		-	-	-	-	-	2	2	-

	PART A – Instrumental method of analysis
SI.No	**Title of the Experiment**
1.	Estimation of iron in a given sample by using electrochemical sensor (potentiometry).
2.	Estimation of amount of copper in E -waste by optical sensor (Colorimetry)
3.	Estimation of mixture of acids using standard NaOH by conductometry sensor.
4.	Estimation of amount of hydrochloric acid using standard sodium hydroxide by pH measurement.
5.	Determination of pKa value of a weak acid using pH sensor.
6.	Determination of viscosity coefficient of a given organic liquid using Ostwald's viscometer.
	PART B – Volumetric method of analysis
7.	Estimation of total alkalinity of the water sample.
8.	Determination of total hardness of a sample of water by using standard EDTA Solution
9.	Determination of chemical oxygen demand (COD) of the given industrial wastewater sample

10.	Estimation of copper in given solution by Iodometry
11.	Estimation of manganese dioxide in pyrolusite ore.
12.	Determination of percentage of iron in rust by external indicator method.
13.	Open ended experiment.
14.	Synthesis of CuO/ZnO nano particles. (DEMO)

CIE Assessment Pattern (50 Marks)

RBT LEVELS		Regular Lab evaluation	Lab internal test
		Max Marks 25	Max Marks 25
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	10	10
L4	Analyze	10	10
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks)

RBT LEVELS		Lab External examination
		Max Marks 50
L1	Remember	-
L2	Understand	10
L3	Apply	20
L4	Analyze	20
L5	Evaluate	
L6	Create	

Suggested Learning Resources:

Reference Books:

1. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
2. A Textbook of Quantitative Inorganic Analysis, Arthur I. Vogel, 5th Edition ISBN0-582-44675-X

APPLIED PHYSICS FOR ENGINEERS (FOR CSE/AIML)			
Course Code	**25PHY12/22**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**4**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principles of quantum mechanics, lasers, electronic materials, sensors, physics in animation and quantum computing.
CO2	Apply mathematical techniques to solve physics-related problems within the context of quantum mechanics, laser technology, electronic material physics, and quantum computing.
CO3	Analyze various physical phenomena through the principles of wave mechanics, laser operation, electronic material behavior and the functioning of sensors and quantum gates.
CO4	Understand how physical principles are used in engineering technology.
CO5	Develop problem-solving skills by tackling physics problems and apply theoretical knowledge to practical situations and engineering challenges.

Mapping of Course Outcomes to Program Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-

MODULE-1	**QUANTUM MECHANICS**	**CO1, CO2, CO3, CO4 CO5**	**8 Hours**

Wave-Particle dualism, de-Broglie hypothesis, phase velocity, group velocity, relationship between phase velocity and group velocity, expression for de-Broglie wavelength from the concept of group velocity, Heisenberg's uncertainty principle, physical significance and application (broadening of spectral lines), Wave function Properties, Physical significance, derivation of Time independent Schrödinger wave equation, eigen value and eigen function, Application of Schrödinger Equation (one dimensional potential well) Numerical problems.

Text Book	1&2

MODULE-2	**LASERS & FIBER OPTICS**	**CO1 CO2, CO3, CO4 CO5**	**8 Hours**

Introduction, Interaction of radiation with matter, expression for energy density at thermal equilibrium in terms of Einstein's coefficient, conditions and requisites of Laser, characteristics of laser, Quantum Dot Laser and their applications, Problems.

Principle and propagation of light in optical fibers, Numerical aperture and Acceptance Angle, Types of Optical fibers, Attenuation, Expression for attenuation co-efficient (derivation), application- point to point telecommunication network, Problems.

Text Book	1&2

MODULE-3	**CONDUCTORS, SEMICONDUCTORS &SUPERCONDUCTORS**	**CO1, CO2, CO3, CO4 CO5**	**8 Hours**

Review of CFET (Qualitative), Quantum free electron theory, Fermi factor, variation of Fermi factor with Energy at T = 0K, T> 0K, Density of states (qualitative), Problems based on fermi factor.

Introduction of semiconductor physics, conductivity in an intrinsic semiconductor , mention of electron concentration in intrinsic semiconductor(Ne) and mention of Nh , expression for intrinsic carrier concentration ni from Law of mass action, expression for position of Fermi level in Intrinsic semiconductors , graphical discussion of variation of fermi level with temperature and concentration in intrinsic and extrinsic semiconductors, Hall Effect and expression for Hall coefficient in n and p type semiconductors(derivation) Application of Hall effect, Problems.

Introduction to Superconductors, Temperature dependence of resistivity, Meissner Effect, Critical Current, Types of Super Conductors, BCS theory(qualitative), Applications in Quantum Computing.

Text Book	2.		
MODULE-4	**SENSORS AND PHYSICS OF ANIMATION**	**CO1, CO2, CO3, CO4 CO5**	**8 Hours**

Sensors: Difference between sensor, transmitter and transducer, working principle of sensors, sensor characteristics, Sensor classification, Sensor types and its applications, Biomedical sensors and Sensors in IOT

Physics of Animation:

Taxonomy of physics-based animation methods, Frames, Frames per second, Size and Scale, Weight and strength, Motion and Timing in animations, Force and acceleration, The Odd rule, Odd rule scenarios, Motion Graphs, Examples of Character animation: Jumping, Parts of Jump, Jump Magnification, Stop Time, Walking: Strides and Steps, Walk Timing. Numerical Problems

Text Book	3&4.		
MODULE-5	**QUANTUM COMPUTING**	**CO1, CO2, CO3 , CO4 CO5**	**8 Hours**

Introduction to Quantum Computing, Moore's law and its end , bits, Qubits, representation of qubit by Bloch sphere, quantum superposition, quantum entanglement, classical and quantum information comparison, difference between classical & quantum computing. Matrix Operations: Pauli Matrices, Unitary Matrix, Row and Column Matrices, Transpose of Matrix, Orthogonality, Orthonormality.Quantum gates:Single Qubit Gates-NOT Gate,Pauli X,Y, and Z gates,Hadamard Gate,Phase Gate,T Gate Multiple Qubit Gates- Controlled Gate, CNOT Gate (4 different input states), Controlled Z Gate,Toffoli Gate

Text Book	5.

CIE Assessment Pattern (50Marks)

RBT Levels		Marks Distribution	
		Test (s)	Alternate assessment (s)
		25	25
L1	Remember	5	5
L2	Understand	10	10
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate		
L6	Create		

SEE Assessment Pattern (50 Marks)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, S Chand Publishing, 18th ed. 2016
2. Solid State Physics, C Kittel, 8th Edition, 2019, Wiley India
3. Measurement, Testing and Sensor Technology: Fundamentals and Application to Materials and Technical Systems 1st ed. 2018 Edition, by Horst Czichos, Springer
4. Physics for Animators,Michele Bousquet with Alejandro Garcia,CRC Press,Taylor and Francis,2016
5. Text Book Fundamentals of Quantum Computing by Venkateswaran Kasirajan, Springer, 2021, ISBN978- 3-030-63688-3 ISBN 978-3-030-63689-0(eBook)

Reference Books:

6. Concepts of Modern Physics, Arthur Beiser, 7th Edition, 2017, Tata McGraw Hill
7. Engineering Physics, B. K. Pandey and S. Chaturvedi,1st edition, 2012, Cengage Publication
8. Quantum Computing -A beginners's Introduction,Parag K Lala,Indian Edition,McGraw Hill reprint 2020

Web links and Video Lectures (e-Resources):

- https://www.compadre.org/quantum/
- https://www.brown.edu/research/labs/mittleman/sites/brown.edu.research.labs.mittleman/files/uploads/lecture2.pdf
- https://www.iitk.ac.in/stc/Publications/DGoswami/marked_Chapter_07.pdf
- https://www.youtube.com/watch?v=_40dpUzzfhA
- https://www.youtube.com/watch?v=QuR969uMICM&t=1s
- https://www.youtube.com/watch?v=vruYFOlM1-Q
- https://www.youtube.com/watch?v=5j37DOD8q4U&list=PLTkE7n2CwG_PH09_q0Q7ttjqE2F9yGeM3
- https://www.youtube.com/watch?v=D8uMVrplSFA
- Quantum computing and networking w/ alkali atom qubit arrays | Qiskit Seminar Series w/ Mark Saffman - YouTube

Virtual Labs

- https://www.vlab.co.in/broad-area-physical-sciences
- https://bop-iitk.vlabs.ac.in/
- https://vlab.amrita.edu/index.php?sub=1&brch=189

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstration of working of QD Laser
- Video demonstration of latest trends in Quantum Computing
- Contents related activities (Activity-based discussions)
  - Flowcharts and Handout preparation by students
  - Group Discussion
  - Seminars

APPLIED PHYSICS FOR ENGINEERS (FOR ECE/EEE)			
Course code	**25PHY12/22**	**CIE Marks**	**50**
L: T:P:S	**3:00:0**	**SEE Marks**	**50**
Hrs / Week	**4**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principles of quantum mechanics, lasers, electronic materials, sensors, physics in animation and dielectric and magnetic materials
CO2	Apply mathematical techniques to solve physics-related problems within the context of quantum mechanics, laser technology, electronic material physics, and dielectric and magnetic materials.
CO3	Analyze various physical phenomena through the principles of wave mechanics, laser operation, electronic and magnetic material behavior and the functioning of sensors.
CO4	Understand how physical principles are used in engineering technology.
CO5	Develop problem-solving skills by tackling physics problems and apply theoretical knowledge to practical situations and engineering challenges.

Mapping of Course Outcomes to Program Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-

MODULE-1	**QUANTUM MECHANICS**	**CO1 CO2 CO3, CO4 CO5**	**8 Hours**

Wave-Particle dualism, de-Broglie hypothesis, phase velocity, group velocity, relationship between phase velocity and group velocity, expression for de-Broglie wavelength from the concept of group velocity, Heisenberg's uncertainty principle, physical significance and application (broadening of spectral lines), Wave function Properties, Physical significance, derivation of Time independent Schrödinger wave equation, eigen value and eigen function, Application of Schrödinger Equation (one dimensional potential well) Numerical problems.

Text Book	1

MODULE-2	**LASERS & FIBER OPTICS**	**CO1 CO2 CO3, CO4 CO5**	**8 Hours**

Introduction, Interaction of radiation with matter, expression for energy density at thermal equilibrium in terms of Einstein's coefficient, conditions and requisites of Laser, characteristics of laser, Quantum Dot Laser and their applications, Problems.

Principle and propagation of light in optical fibers, Numerical aperture and Acceptance Angle, Types of Optical fibers, Attenuation, Expression for attenuation co-efficient (derivation), application- point to point telecommunication network, Problems.

Text Book	1& 2

MODULE-3	**CONDUCTORS, SEMICONDUCTORS &SUPERCONDUCTORS**	**CO1 CO2 CO3 CO4 CO5**	**8 Hours**

Review of CFET (Qualitative), Quantum free electron theory, Fermi factor, variation of Fermi factor with Energy at T = 0K, T> 0K, Density of states (qualitative), Problems based on fermi factor.

Introduction of semiconductor physics, conductivity in an intrinsic semiconductor , mention of electron concentration in intrinsic semiconductor(Ne) and mention of Nh , expression for intrinsic carrier concentration ni from Law of mass action, expression for position of Fermi level in Intrinsic semiconductors , graphical discussion of variation of fermi level with temperature and concentration in intrinsic and extrinsic semiconductors, Hall Effect and expression for Hall coefficient in n and p type semiconductors(derivation) Application of Hall effect, Problems.

Introduction to Superconductors, Temperature dependence of resistivity, Meissner Effect, Critical Current, Types of Super Conductors, BCS theory(qualitative), Applications in Quantum Computing.

Text Book	2&5

MODULE-4	**SENSORS AND PHYSICS OF ANIMATION**	**CO1 CO2 CO3, CO4 CO5**	**8 Hours**

Sensors: Difference between sensor, transmitter and transducer, working principle of sensors, sensor characteristics, Sensor classification, Sensor types and its applications, Biomedical sensors and Sensors in IOT
Physics of Animation:
Taxonomy of physics-based animation methods, Frames, Frames per second, Size and Scale, Weight and strength, Motion and Timing in animations, Force and acceleration, The Odd rule, Odd rule scenarios, Motion Graphs, Examples of Character animation: Jumping, Parts of Jump, Jump Magnification, Stop Time, Walking: Strides and Steps, Walk Timing. Numerical Problems

Text Book	3 &4

MODULE-5	**DIELECTRIC AND MAGNETIC MATERIALS**	**CO1 CO2 CO3, CO4 CO5**	**8 Hours**

Dielectrics, types, polarization, types and temperature dependence of polarization, Polarizability, Internal field (Expression for One dimensional solid), Clausius-Mossotti equation (Derivation), Dielectric loss, Expression for dielectric loss (derivation)Dielectric relaxation, frequency dependence of εr, Ferroelectrics
– properties & applications -Piezoelectrics – properties and applications.
Introduction to magnetic materials: Paramagnetic, Diamagnetic and Ferromagnetic Materials- Properties, Ferromagnetic Domain theory, B-H curve, Soft and hard magnetic materials, applications, Problems on dielectrics

Textbook	1&5

CIE Assessment Pattern (50 Marks)

RBT Levels		**Marks Distribution**	
		Test (s)	**Alternate assessment (s)**
		25	**25**
L1	**Remember**	**5**	**5**
L2	**Understand**	**10**	**10**
L3	**Apply**	**5**	**5**
L4	**Analyze**	**5**	**5**
L5	**Evaluate**		
L6	**Create**		

SEE Assessment Pattern (50 Marks)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**10**
L2	**Understand**	**20**
L3	**Apply**	**10**
L4	**Analyze**	**10**
L5	**Evaluate**	
L6	**Create**	**--**

Suggested Learning Resources:

Text Books:

1. Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, S Chand Publishing, 18th ed. 2016
2. Solid State Physics, C Kittel, 8th Edition, 2019, Wiley India
3. Measurement, Testing and Sensor Technology: Fundamentals and Application to Materials and Technical Systems 1st ed. 2018 Edition, by Horst Czichos, Springer
4. Physics for Animators,Michele Bousquet with Alejandro Garcia,CRC Press,Taylor and Francis,2016
5. Text Book Fundamentals of Quantum Computing by Venkateswaran Kasirajan, Springer, 2021, ISBN978- 3-030-63688-3 ISBN 978-3-030-63689-0 (eBook)

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6. Concepts of Modern Physics, Arthur Beiser, 7th Edition, 2017, Tata McGraw Hill
7. Engineering Physics, B. K. Pandey and S. Chaturvedi,1st edition, 2012, Cengage Publication
8. Quantum Computing -A beginners's Introduction,Parag K Lala,Indian Edition,McGraw Hill reprint 2020

Web links and Video Lectures (e-Resources):

- https://www.compadre.org/quantum/
- https://www.brown.edu/research/labs/mittleman/sites/brown.edu.research.labs.mittleman/files/uploads/lecture2.pdf
- https://www.iitk.ac.in/stc/Publications/DGoswami/marked_Chapter_07.pdf
- https://www.youtube.com/watch?v=_40dpUzzfhA
- https://www.youtube.com/watch?v=QuR969uMICM&t=1s
- https://www.youtube.com/watch?v=vruYFOlM1-Q
- https://www.youtube.com/watch?v=5j37DOD8q4U&list=PLTkE7n2CwG_PH09_q0Q7ttjqE2F9yGeM3
- https://www.youtube.com/watch?v=D8uMVrplSFA
- Quantum computing and networking w/ alkali atom qubit arrays | Qiskit Seminar Series w/ Mark Saffman - YouTube

Virtual Labs

- https://www.vlab.co.in/broad-area-physical-sciences
- https://bop-iitk.vlabs.ac.in/
- https://vlab.amrita.edu/index.php?sub=1&brch=189

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstration of working of QD Laser
- Video demonstration of latest trends in Quantum Computing
- Contents related activities (Activity-based discussions)
- ➢ Flowcharts and Handout preparation by students
- ➢ Group Discussion
- ➢ Seminars

APPLIED PHYSICS FOR ENGINEERS (FOR ME)			
Course code	**25PHY12/22**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**4**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principles of quantum mechanics, lasers, electronic materials, sensors, physics in animation and Instrumentation physics.
CO2	Apply mathematical techniques to solve physics-related problems within the context of quantum mechanics, laser technology, electronic material physics, and Instrumentation physics.
CO3	Analyze various physical phenomena through the principles of wave mechanics, laser operation, electronic material behavior, material characterization and the functioning of sensors.
CO4	Understand how physical principles are used in engineering technology.
CO5	Develop problem-solving skills by tackling physics problems and apply theoretical knowledge to practical situations and engineering challenges.

Mapping of Course Outcomes to Program Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-

MODULE-1	**QUANTUM MECHANICS**	**CO1 CO2 CO3, CO4 CO5**	**8 Hours**

Wave-Particle dualism, de-Broglie hypothesis, phase velocity, group velocity, relationship between phase velocity and group velocity, expression for de-Broglie wavelength from the concept of group velocity, Heisenberg's uncertainty principle, physical significance and application (broadening of spectral lines), Wave function Properties, Physical significance, derivation of Time independent Schrödinger wave equation, eigen value and eigen function, Application of Schrödinger Equation (one dimensional potential well) Numerical problems.

Text Book	1

MODULE-2	**LASERS & FIBER OPTICS**	**CO1 CO2 CO3, CO4 CO5**	**8 Hours**

Introduction, Interaction of radiation with matter, expression for energy density at thermal equilibrium in terms of Einstein's coefficient, conditions and requisites of Laser, characteristics of laser, Quantum Dot Laser and their applications, Problems.

Principle and propagation of light in optical fibers, Numerical aperture and Acceptance Angle, Types of Optical fibers, Attenuation, Expression for attenuation co-efficient (derivation), application- point to point communication, Problems

Text Book	1&2

MODULE-3	**CONDUCTORS, SEMICONDUCTORS &SUPERCONDUCTORS**	**CO1 CO2 CO3 CO4 CO5**	**8 Hours**

Review of CFET (Qualitative), Quantum free electron theory, Fermi factor, variation of Fermi factor with Energy at T = 0K, T> 0K, Density of states (qualitative), Problems based on fermi factor.

Introduction of semiconductor physics, conductivity in an intrinsic semiconductor , mention of electron concentration in intrinsic semiconductor(Ne) and mention of Nh , expression for intrinsic carrier concentration ni from Law of mass action, expression for position of Fermi level in Intrinsic semiconductors , graphical discussion of variation of fermi level with temperature and concentration in intrinsic and extrinsic semiconductors, Hall Effect and expression for Hall coefficient in n and p type semiconductors(derivation) Application of Hall effect, Problems.

Introduction to Superconductors, Temperature dependence of resistivity, Meissner Effect, Critical Current, Types of Super Conductors, BCS theory(qualitative), Applications in Quantum Computing.

Text Book	1&2		
MODULE-4	**SENSORS AND PHYSICS OF ANIMATION**	**CO1 CO2 CO3, CO4 CO5**	**8 Hours**

Sensors: Difference between sensor, transmitter and transducer, working principle of sensors, sensor characteristics, Sensor classification, Sensor types and its applications, Biomedical sensors and Sensors in IOT

Physics of Animation:

Taxonomy of physics-based animation methods, Frames, Frames per second, Size and Scale, Weight and strength, Motion and Timing in animations, Force and acceleration, The Odd rule, Odd rule scenarios, Motion Graphs, Examples of Character animation: Jumping, Parts of Jump, Jump Magnification, Stop Time, Walking: Strides and Steps, Walk Timing. Numerical Problems

Text Book	3&4		
MODULE-5	**INSTRUMENTATION PHYSICS**	**CO1 CO2 CO3, CO4 CO5**	**8 Hours**

Instrumentation Physics

Introduction to materials – Nanomaterials- Synthesis, properties and applications, Composites-Types. Properties and applications Introduction to characterization techniques, XRD- Bragg's Law, X-ray Diffractometer, Particle size determination using XRD, XPS – Principle, instrumentation and application, AFM - Principle, instrumentation and application, SEM – Principle, instrumentation, Application and advantages. Problems on XRD

Text Book	5

CIE Assessment Pattern (50 Marks)

RBT Levels		**Marks Distribution**	
		Test (s)	**Alternate assessment (s)**
		25	**25**
L1	**Remember**	**5**	**5**
L2	**Understand**	**10**	**10**
L3	**Apply**	**5**	**5**
L4	**Analyze**	**5**	**5**
L5	**Evaluate**		
L6	**Create**		

SEE Assessment Pattern (50 Marks)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**10**
L2	**Understand**	**20**
L3	**Apply**	**10**
L4	**Analyze**	**10**
L5	**Evaluate**	**-**
L6	**Create**	**--**

Suggested Learning Resources:

Text Books:

1. Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, S Chand Publishing, 18th ed. 2016
2. Solid State Physics, C Kittel, 8th Edition, 2019, Wiley India
3. Measurement, Testing and Sensor Technology: Fundamentals and Application to Materials and Technical Systems 1st ed. 2018 Edition, by Horst Czichos, Springer
4. Physics for Animators,Michele Bousquet with Alejandro Garcia,CRC Press,Taylor and Francis,2016
5. Text Book Fundamentals of Quantum Computing by Venkateswaran Kasirajan, Springer, 2021, ISBN978 - 3-030-63688-3 ISBN 978-3-030-63689-0 (eBook)

Reference Books:

9. Concepts of Modern Physics, Arthur Beiser, 7th Edition, 2017, Tata McGraw Hill
10. Engineering Physics, B. K. Pandey and S. Chaturvedi,1st edition, 2012, Cengage Publication
11. Quantum Computing -A beginners's Introduction,Parag K Lala,Indian Edition,McGraw Hill reprint 2020

Web links and Video Lectures (e-Resources):

- https://www.compadre.org/quantum/
- https://www.brown.edu/research/labs/mittleman/sites/brown.edu.research.labs.mittleman/files/uploads/lecture2.pdf
- https://www.iitk.ac.in/stc/Publications/DGoswami/marked_Chapter_07.pdf
- https://www.youtube.com/watch?v=_40dpUzzfhA
- https://www.youtube.com/watch?v=QuR969uMICM&t=1s
- https://www.youtube.com/watch?v=vruYFOlM1-Q
- https://www.youtube.com/watch?v=5j37DOD8q4U&list=PLTkE7n2CwG_PH09_q0Q7ttjqE2F9y GeM3
- https://www.youtube.com/watch?v=D8uMVrplSFA
- Quantum computing and networking w/ alkali atom qubit arrays | Qiskit Seminar Series w/ Mark Saffman - YouTube

Virtual Labs

- https://www.vlab.co.in/broad-area-physical-sciences
- https://bop-iitk.vlabs.ac.in/
- https://vlab.amrita.edu/index.php?sub=1&brch=189

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstration of working of QD Laser
- Video demonstration of latest trends in Quantum Computing
- Contents related activities (Activity-based discussions)
  - ➢ Flowcharts and Handout preparation by students
  - ➢ Group Discussion
  - ➢ Seminars

APPLIED PHYSICS LAB FOR ENGINEERS

Course Code	**25PHL12/22**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Develop the ability to experimentally determine and analyse fundamental physical constants and material properties using scientific methods.
CO2	Apply core principles of physics to investigate and interpret phenomena through practical experimentation
CO3	Utilize modern instruments and tools to collect, analyze, and validate experimental data, reinforcing theoretical concepts.
CO4	Investigate advanced scientific and engineering concepts through exploratory experiments that foster critical thinking and problem-solving,

Mapping of Course Outcomes to Program Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	1	-	-	-	1	1	1
CO2	3	2	2	-	2	-	-	-	1	1	1
CO3	2	1	2	-	2	-	-	-	1	1	1
CO4	2	2	3		2	-	-	-	1	1	1

List of Experiments	**PART - A**	**COs**
Sl.No	**Title of the Experiment**	
1.	Determination of Planck ‘s constant using LED	CO1, CO2, CO3, CO4
2.	Stefan’s Law: To verify Stefan’s Law	
3.	Dielectric constant**:** To determine the dielectric constant of given dielectric by charge and discharge method	
4.	Laser Diffraction: To determine the wavelength of Laser using grating	
5.	Numerical Aperture: To determine the numerical aperture of Optical Fiber	
6.	Fermi Energy: To determine the Fermi energy of copper.	
7.	Photodiode Characteristics: To study the V-I characteristics of photo diode for different light intensity in reverse bias condition	
8.	Energy Gap: To find the energy gap of a given semiconductor-Demonstration	
9.	Hall Effect: To measure Hall Coefficient of materials.	
10.	Resistivity: Four Probe method	
11.	Particle Size Determination – Using LASER	
12.	Diffractometry: Screen distance effects	

List of Open-Ended Experiments PART - B

1.	Wavelength determination of an IR LED using Planck’s constant	CO1, CO2, CO3, CO4
2.	Investigating the light-current relationship in a photodiode	
3.	Laser diffraction: effect of screen distance on particle sizing	
4.	Investigating signal loss in optical fibers due to bending	

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution	
		Regular lab Assessment	Lab Internal test
		25	25
L1	Remember		
L2	Understand	05	05
L3	Apply	10	10
L4	Analyze	05	05
L5	Evaluate	05	05
L6	Create		

SEE- Semester End Examination (50 Marks)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	08
L3	Apply	20
L4	Analyze	12
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Reference books.

1. Engineering Lab Manual by WBUT-New Age International Publishers.

2.Applied Physics Lab Manual by Anoop Sing Yadav.

Web links and Video Lectures (e-Resources):

- https://www.vlab.co.in/broad-area-physical-sciences
- https://bop-iitk.vlabs.ac.in/
- https://vlab.amrita.edu/index.php?sub=1&brch=189
- https://phet.colorado.edu/en/simulations/filter?type=html
- https://www.falstad.com/circuit/
- https://apps.kde.org/step/
- https://www.circuitlab.com/

ENGINEERING SCIENCE COURSES I&II (ESC I&II)

INTRODUCTION TO ELECTRONICS AND COMMUNICATION ENGINEERING			
Course Code	25ESC131/231	**CIE Marks**	50
L:T:P:S	3:0:0:0	**SEE Marks**	50
Hrs / Week	4	**Total Marks**	100
Credits	03	**Exam Hours**	03

Course outcomes: At the end of the course, the student will be able to:

CO1	Explain the properties of semiconductors, the operation of PN junction diodes, and their applications in rectifiers and power supply circuits
CO2	Apply the principles of semiconductor devices for the construction, characteristics, and applications of BJT and FET
CO3	Analyze the operation of operational amplifiers and oscillators for different applications
CO4	Illustrate the fundamentals of communication systems, types of modulation, and basic receiver principles
CO5	Apply the principles of digital logic, including number systems, Boolean algebra, and logic gates, to solve basic digital design problems
CO6	Engage in independent learning as a member of a team, and use ICT for effective presentation of the study related to electronic systems

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	2	1	2	-	1	2	2	-	2	-	-

MODULE-1	**INTRODUCTION TO SEMICONDUCTOR: DIODE AND APPLICATIONS**	CO1 CO6	**8 Hours**

Introduction to materials used in electronics, P-N Junction diode – operation, characteristics, Applications: Half-Wave rectifier, Center-tapped Full Wave Rectifier, Bridge Rectifier, Power supply filters, Voltage regulators.

Self-study	Study the basic structure of PV solar cell.
Text Book	Textbook 1: 1.2, 2.1, 2.2, 2.4, 2.5, 2.6

MODULE-2	**TRANSISTORS: BJT AND FET**	CO2 CO6	**8 Hours**

Bipolar Junction Transistor: BJT Structure, BJT Operation, Characteristics and parameters, BJT as an Amplifier, BJT as a switch. Biasing, Need for Biasing, DC operating point (Q-point).
JFET: JFET Structure, JFET Operation, JFET Characteristics

Self-study	Phototransistor and its operation
Text Book	Textbook 1: 4.1,4.2,4.3,4.4, 4.5, 5.1, 8.1

MODULE-3	**OPERATIONAL AMPLIFIERS AND OSCILLATORS**	CO3 CO6	**8 Hours**

Introduction to Op-Amps, Op-Amp Parameters, Inverting and Non-inverting Amplifiers.
Oscillators: Positive Feedback, Condition for Oscillations, Wein Bridge Oscillator, RC phase shift oscillator.

Case Study	Applications of Op-amp
Text Book	Textbook 1: 12.1, 12.2, 12.4, 16.1, 16.2, 16.3

MODULE-4	**COMMUNICATION SYSTEMS**	CO4 CO6	**8 Hours**

Elements of Communication system, Need for modulation, types of communication systems, Analog modulation: Amplitude modulation, Frequency modulation, and Phase modulation (Definition and waveforms only), Digital modulation: ASK, FSK, PSK (Definition and waveforms only), Super heterodyne receiver.

Case study	Converting an analog signal to a digital signal.
Text Book	Textbook 2: 1.2, 1.3, 3.1, 4.1.1, 4.1.2, 6.2, 7.3.2

MODULE-5	**FUNDAMENTALS OF DIGITAL LOGIC**	CO5 CO6	**8 Hours**

Number Systems, Conversion from one number system to another, 1's and 2's Complement, Binary subtraction using 1's and 2's complement. Digital Electronics: Logic gates, NAND and NOR as universal gates, Boolean Algebra Theorems, De Morgan's theorem, Boolean algebraic simplification.

Case study	4-bit adder simulator
Text Book	Textbook 3: 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4, 2.7

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution			
		Test (s)	AAT1	AAT2	AAT3
		25	7.5	7.5	10
L1	Remember	10	2.5	2.5	-
L2	Understand	10	5	-	-
L3	Apply	5	-	5	-
L4	Analyze	-	-	-	5
L5	Evaluate	-	-	-	-
L6	Create	-	-	-	5

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	20
L2	Understand	20
L3	Apply	10
L4	Analyze	-
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Electronic Devices, Floyd, Thomas L.,10th edition, 2021, Pearson Education, Inc. ISBN-13: 978-0-13-254985-1
2. Electronic Communication Systems, George Kennedy, 5th edition, 2008, McGraw HILL Education Private Limited, ISBN:978-0-07-107782-8.
3. Digital Logic and Computer Design, M. Morris Mano, 5th edition, 2002, PHI, ISBN:978-0131989269.

Reference Books:

1. Digital Electronics: Principles, Devices and Applications, Anil K Maini, British Library Cataloguing in Publication Data, ISBN 978-0-470-03214-5 (HB)
2. Principles of Electronics, V. K. Mehta, 12th edition, 2020, S. Chand Publishing, ISBN:978-9352838277

Web links and Video Lectures (e-Resources):

- Basic Electronics: https://nptel.ac.in/courses/122106025
- Embedded system: https://nptel.ac.in/courses/108102045
- https://www.youtube.com/watch7vHbGxhPG3H5BQ

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Hands-On Component Identification
- Group Projects
- Group activity to diagnose fault finding in basic simple electronic circuits.

INTRODUCTION TO ELECTRICAL ENGINEERING			
Course Code	**25ESC132/232**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principle of operation, components, layout, environmental and social issues of various power plants.
CO2	Recognize the energy properties of electric elements and the techniques to measure voltage and current.
CO3	Analyze the active and passive elements and performance parameters of ac circuits.
CO4	Choose the proper type and specification of measuring procedure and instruments for different industrial, commercial, and domestic applications.
CO5	Evaluate the basic operation and performance of electrical machines and can select appropriate machine for different purposes.
CO6	Use the concepts of tariff and different safety measures of electrical appliances.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	1	-	-	-	-	-	-	-
CO3	3	1	-	1	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	1	-	-	-	-	-	-	-
CO6	2	1	-	1	-	-	-	-	-	-	-

MODULE-1	**POWER PLANTS AND DC CIRCUITS**	**CO1, CO2**	**8 Hours**

Power Generation:
Renewable and Non-Renewable energy resources - Hydel, Nuclear, Solar & wind power generation (Block Diagram approach) - Electrical power system structure-Single line diagram.

DC Circuits:
Ohm's Law and its limitations- KCL & KVL-series, parallel, series-parallel circuits-Simple Numerical

Text Book	Text Book 1: Chapter 1,2 & 3, Chapter 15 Text Book 5: Chapter 17, 1 & 2
Self-Study	A case study of the power sector in India

MODULE-2	**AC CIRCUITS**	**CO3**	**8 Hours**

A.C. Fundamentals:
Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor (only definitions)-Voltage and current relationship with phasor diagrams in R, L, and C Circuits- Series R-L, R-C, R-L-C circuits, concept of impedance and admittance, Concept of active, reactive, apparent, complex power and power factor

Three Phase Circuits:
Three phase AC quantity, advantages, and limitations-star and delta connection-relationship between line and phase quantities.

Text Book	Text Book 1: Chapter 7,8 & 9
Self-Study	AC Electrical Circuit Analysis- Watching NPTEL video lecture series and Identification of phase, Neutral and Earth wires for connection

MODULE-3	**ELECTRICAL MEASUREMENTS AND WIRING**	**CO4**	**8 Hours**

Measurement and Instrumentation:
Functional elements of measuring instruments – Types of measuring instruments – Standards, Errors, and calibration-Construction and working Principle of Permanent magnet moving coil and moving iron instruments-Attraction type, Single phase wattmeter and Single-phase energy meter and digital meters.

Domestic Wiring:
Requirements, Types of wiring: Two way and three-way control of lamp.

Text Book	Text Book 1: Chapter 13; Text Book 4: Chapter 15; Text Book 3: Chapter 1,2
Self-study	Study of electrical safety measures and protective devices and Identification of phase, Neutral and Earth wires for connection

MODULE-4	ELECTRICAL MACHINES	CO5	8 Hours

DC Generator:
Principle of operation-constructional details, types-induced EMF expression.
DC Motor:
Principle of operation, back emf and its significance- Torque equation, types of motors, Applications of DC machines.
Transformers:
Principle of operation, construction of single-phase transformers, Types, EMF equation and losses in transformer, Definition of regulation and efficiency.

Text Book	Text Book 1: Chapter 10,11 & 12; Text Book 2: Chapter 9 & 10
Self-study	Watching NPTEL video lecture on Electrical Machines and Magnetic circuits

MODULE-5	TARIFF CALCULATION AND ELECTRICAL SAFETY	CO6	8 Hours

Energy conservation and load calculation:
Energy conservation and its necessity-Power rating and load calculations of domestic appliances -tariff and its types.
Equipment Safety measures:
Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits, Personal safety measures -Electric Shock, Earthing and its types, Safety Precautions to avoid shock.
An over view of electric vehicles - block diagram approach.

Text Book	Text Book 1:782-796
Self-study	Case study on Electrical safety measures

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	10	5	3
L2	Understand	10	5	2
L3	Apply	5	5	5
L4	Analyze	-	-	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	20
L2	Understand	20
L3	Apply	10
L4	Analyze	--
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:
TEXT BOOKS:

1) Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, 2nd Edition 2019, ISBN-13: 978-9353167219
2) Principles of Electrical Engineering and Electronics, V.K. Mehta, S Chand Publishing, 2019, ISBN: ISBN : 9788121942980
3) Electrical and electronic measurements and instrumentation by A K Sawhney, Dhanpat Rai & Co. (P) Limited,2015, ISBn-10: 8177001000, ISBN-13: 978-8177001006
4) Basic Electrical and Electronics Engineering, D P Kothari, I J Nagrath, Second Edition, McGraw Hill Publishers, 2020, ISBN-10: 9389811244,ISBN-13: 978-9389811247

Reference books:

1) Basic Electrical and Electronics Engineering, S.K. Bhattacharya, Pearson Education, 2017, ISBN: 9789332586505
2) A textbook of Electrical Technology by B.L. Theraja, S Chand Publication, 2014, ISBN: 8121924413

Web links and Video Lectures (e-Resources):

1. AC and DC circuits: https://www.youtube.com/watch?v=ERIToctYUcQ
2. Basic concepts and examples: https://youtu.be/3TR_DS_7z2w
3. Ohm's Law, KVL, KCL : https://youtu.be/FjaJEo7knF4
4. Electrical measurements and instrumentation: https://www.youtube.com/watch?v=xLjk5DrScEU&list=PLt5syl71JKf3yk9h0mWg6vCNn1Jmb72JJ
5. Electrical machines: https://www.youtube.com/watch?v=KUSBS11qpX0&list=PLohtAIfLLw8cdi1iOLyLNX1f839KSXDnl

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on different topics
- Problem solving approach
- Collaborative learning
- Seminars
- Experiential learning approach through lab sessions (Hardware/Software)

INTRODUCTION TO MECHANICAL ENGINEERING

Course Code	**25ESC133**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Develop basic Knowledge on Mechanical Engineering, Fundamentals and Energy Sources
CO2	Understand the concept of different types of Refrigeration
CO3	know the concept of IC engines and Future Mobility vehicles.
CO4	Understand the concept of different types of Machine tool operations and Modern Manufacturing Processes like 3D printing.
CO5	Acquire a basic understanding role of Mechanical Engineering in the Robotics and Automation in industry.
CO6	Understand advances in mechanical engineering and industry applications

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
25ESC133.1	3	3	2	-	-	-	-	-	-	-	-	-	-
25ESC133.2	3	3	2	-	-	-	-	-	-	-	-	-	-
25ESC133.3	3	3	2	-	-	-	-	-	-	-	-	-	-
25ESC133.4	3	3	2	-	-	-	-	-	-	-	-	-	-
25ESC133.5	3	3	2	-	-	-	-	-	-	-	-	-	-
25ESC133.6	3	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**ENERGY SOURCES**	**25ESC133.1**	**8 Hours**

Definition of Energy, Classification of Energy Sources, and Utilization of Various Energy Sources: Hydel, Solar, wind, Tidal, Geo-Thermal and bio-fuels, Environmental issues like Global warming and Ozone depletion.

Applications	Energy resource Growth in Global Market
Text Book	Text Book 1: Ch. 1.1,1.2,1.3,1.4, 2.1,2.2,2.3

MODULE-2	**REFRIGERATION AND AIR-CONDITIONING**	**25ESC133.2, 25ESC133.3**	**8 Hours**

Principle of refrigeration, Refrigeration effect, Ton of Refrigeration, COP, Refrigerants and their Desirable properties. Principles and Operation of Vapor Compression and Vapor absorption Refrigeration. Definition of Air- Conditioning, Principles and Operation of window type room Air Conditioning Domestic and Industrial Applications of Refrigerator.

Self-study	Study the different types of Refrigerators and AC, also its features.
Text Book	Text Book 1: Ch.3.1,3.2,3.3

MODULE-3	**HYBRID VEHICLES, ELECTRIC VEHICLES AND IC ENGINES**	**25ESC133.3**	**8 Hours**

Introduction to IC Engines: Components and Working Principles, 4-Strokes Petrol and Diesel Engines 2- stroke Engine, Application of IC Engines.
Insight into Future Mobility; Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of EVs and Hybrid vehicles.

Self-study	Demonstration of IC engines
Text Book	Text Book 1: Ch. 3.4,3.5,3.6

MODULE-4	**MANUFACTURING SCIENCE**	**25ESC133.4, 25ESC133.5**	**8 Hours**

Working Principle of lathe, Lathe operations: Turning, facing, knurling. Working principles of Drilling Machine, drilling operations: drilling, boring, reaming. (No sketches of machine tools, sketches to be used only for explaining the operations).
Introduction to Advanced Manufacturing Science: Introduction 3D printing and its Application in various field.

Applications	Demonstration of lathe and drilling operations
Text Book	Text Book 1-Ch.-5.1,5.2,5.3,5.4

MODULE-5	ROBOTICS AND AI	25ESC133.6	8 Hours

Definition of Robot, Basic Anatomy of Robot, Components of Robot, types of Robotic joints
Various Configuration of Robot, End Effector, Robot Applications.
Introduction to AI and Its Applications: Definition of AI and Application of AI in various field.

Case Study	Demonstration on Pick and Place robots (Visit to Robotics lab)
Text Book	Text Book 2-Ch-6.1,6.2,6.3,6.4

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	10	5	5
L4	Analyze	5	5	5
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text books:

1) Kestoor Praveen, M R Ramesh, Elements of Mechanical Engineering, Suggi Publishers, 2nd Ed, 2016, ISBN555-1234003176
2) Groover. M.P. Industrial Robotics, technology, programming, and application, Mc-Graw Hill, 2nd Ed, 2017, ISBN978-1259006210

Reference Books:

1) Husain Iqbal, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 3rd Edition, ISBN978-0849314667
2) Mikell P. Grover, Automation Production Systems and Computer Integrated Manufacturing, PHI, 5th Ed, 2024, ISBN 978-9361592959
3) Ian Gibson, David. W. Rosen, Brent Stucker, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer, 2nd Ed, 2014, ISBN978-1493921126
4) K R Gopala Krishna, Elements of Mechanical Engineering, Subhash Publications, 38th Ed, 2018, ISBN555-1234106005

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/112104526
- https://nptel.ac.in/courses/112104616
- https://nptel.ac.in/courses/112104769
- https://www.youtube.com/watch?v=EVqBzOGQlkI
- https://www.youtube.com/watch?v=GF5C8dH4f5o
- https://www.youtube.com/watch?v=0MeAZFFqmek&list=PLdLe0dTcWW-u_dCcNGoAK8fx2PiS5gkVu
- https://youtu.be/i1ojp09VXHY

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Automobile industry visit
- IC engine Lab Visit

ENGINEERING SCIENCE COURSE (ESC)

COMPUTER AIDED ENGINEERING DRAWING			
Course Code	**25CAD15/25**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**5**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

CO1	Interpret the position of points in different quadrants using orthographic projection principles.
CO2	Construct projections of plane surfaces inclined to one or both reference planes and analyze their true shapes.
CO3	Develop and analyze projections of simple and composite solids placed in various orientations with respect to reference planes.
CO4	Generate accurate orthographic views (front, top, side) of 3D objects and relate them to engineering standards.
CO5	Construct isometric projections and Visualize 3D objects effectively using manual and CAD methods.
CO6	Apply projection methods and CAD drawing skills to real-world engineering problems such as machine components, structural parts, and design visualization.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	2	-	-	-	-	-	-	-	-	-
CO6	3	3	2	-	2	-	-	-	-	-	-	-	-	-

MODULE-1	**PROJECTIONS OF POINTS AND PLANE SURFACES**	**CO1, CO2**	**8 Hours**

Introduction: Significance of Engineering drawing, BIS Conventions, Lettering, Dimensioning, geometrical constructions and freehand practicing. Introduction to software, commands used for engineering drawing

Projections of Points: Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.

Projections of plane surfaces– Introduction, triangle, square, rectangle, pentagon, hexagon and circle.

Self-study	List the different types of plane surfaces for their dimensions and orientation.
Text Book	Text Book 1: 5.1-5.6,6.1-6.4,7.1-1.13

MODULE-2	**PROJECTIONS OF SOLIDS**	**CO3**	**8 Hours**

Introduction, Projections of prisms, pyramids, cylinders and cones in different positions.

Self-study	Study the orientation of different types of solids for their shapes and dimensions.
Text Book	Text Book 1: 8.1-8.5

MODULE-3	**ORTHOGRAPHIC PROJECTIONS OF SOLIDS**	**CO4**	**8 Hours**

Conversion of pictorial views into orthographic projections of simple machine parts.

Case Study	Explore the different types of machine components to identify visible and invisible lines.
Text Book	Text Book 2: 2.1

MODULE-4	**ISOMETRIC PROJECTIONS**	**CO5**	**8 Hours**

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of cubes, right regular prisms, pyramids, cylinders, cones, spheres, hemispheres and combination of solids (Isometric projection of two simple solids).

Self-study	Study the different Mechanical components for the visible and invisible edges.
Text Book	Text Book 1: 11.1-11.7

MODULE-5	**MULTI-DISCIPLINARY APPLICATIONS AND PRACTICE**	**CO6**	**8 Hours**

Components Visualization**:** (For CIE Only): Concept of Industrial drawing;
3D Modelling using Google sketch-up, Testing using Tinker CAD, Simulation by Energy 2D tool, and 3D printing.

Case Study	Explore the different modeling software tools used in automobile and aerospace application
Text Book	Text Book 1: 10.1-10.3

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab Internal
		25	5	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	2	10
L4	Analyze	5	2	10
L5	Evaluate	5	1	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text books:

1. Engineering Drawing, Trymbaka Murthy, I.K International Publishing House Pvt Ltd, Bangalore,2013. ISBN- 13-9380578606
2. Machine Drawing, K. R. Gopala Krishna, Subhas Stores, Bangalore,2005. ASIN : B074Y8HWKF

Reference Books:

1. French, Thomas E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company (2005). ISBN-13-9780071004251
2. A Textbook of Engineering Graphics by K. Venugopal & Prabhu Raj, New Age International, 2009. ISBN-13-9788122424577
3. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production- Luzadder Warren J., Duff John M.,Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi. ISBN-13-9780134808499
4. Bhattacharya S. K., Electrical Engineering Drawing, New Age International publishers, second edition 1998, reprint 2005.
5. Chris Schroder, Printed Circuit Board Design using AutoCAD, Newnes, 1997.

Web links and Video Lectures (e-Resources):

- IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
- IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
- IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.
- **https://nptel.ac.in/courses/112/103/112103019/**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrate with 3D printed/wooden models of cone, prism, cylinder, pyramid — rotate them physically and let students predict projections.
- Visit to machine shop: showing machine components (bearing block, flange, bracket) and ask students to visualize and sketch their front, top, side views.
- Convert 2D orthographic drawings into 3D isometric projections using CAD tools

PROGRAM SPECIFIC COURSES (PSC)

ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING			
Course Code	**25ECE141**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**4**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply the principle of semiconductor devices for real time applications
CO2	Analyze the different concepts of number systems for digital circuits
CO3	Construct combinational and sequential circuits using the basic logic gates
CO4	Demonstrate knowledge of core engineering concepts to analyze the principles and usage of embedded systems.
CO5	Analyze the modulation techniques and working of the GSM network.
CO6	Engage in independent learning as a member of a team, submit a report, and use ICT for effective presentation of the study on assigned topics related to electronic systems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	2	1	2	-	1	2	2	-	2	-	-

MODULE-1	**SEMICONDUCTOR DIODE AND APPLICATIONS**	**CO1 CO6**	**8 Hours**

P-N Junction diode – its principle, characteristics and parameters, Applications: Half-Wave rectifier, Center tapped Full Wave Rectifier, Bridge Rectifier, Ripple factor and efficiency for half-wave and full rectifier, Zener diode as a Voltage regulator, Numericals.

Text Book	Textbook1: 3.1, 4.1, 4.3, 4.4, 5.1

MODULE-2	**FUNDAMENTALS OF TRANSISTORS AND OSCILLATORS IN ELECTRONICS**	**CO1 CO6**	**8 Hours**

Bipolar Junction Transistor: BJT Operation, Common Emitter Characteristics. Biasing, DC Load Line, Need for Biasing, Single-Stage CE Amplifier.
MOSFET: Introduction to MOSFET theory, Operation and characteristics of Enhancement MOSFET for N-channel. Comparison between BJT and MOSFET.
Oscillator: Barkhausen criterion, Crystal controlled oscillator.

Text Book	Textbook2:4.1,4.2,4.4,4.6, 9.5, 5.1, 5.4, 6.4, 16.1, 16.9

MODULE-3	**FUNDAMENTALS OF NUMBER SYSTEMS AND DIGITAL ELECTRONICS**	**CO2 CO6**	**8 Hours**

Number Systems: Introduction, Number Systems (Decimal, Binary, Hexadecimal, Octal), Conversion from one number system to other, Complement of Binary Numbers (1's and 2's), Binary subtraction using 1's and 2's complement, Numericals.
Digital Electronics: Logic gates, NAND and NOR as universal gates, Boolean Algebra, De Morgan's theorem, Simplification of Boolean Expressions, Canonical and Standard forms, Numericals.

Text Book	Textbook 2: 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4, 2.7

MODULE-4	**CORE COMPONENTS OF DIGITAL SYSTEMS**	**CO3 CO6**	**8 Hours**

Building blocks of a Digital system: Combinational circuits - Half Adder, Full Adder, Half Subtractor, Full Subtractor. Sequential circuits (SR Latch using NAND gates, Flip-Flops [SR, JK, D, T]. Application of flip-flops: Asynchronous counter.

Text Book	Textbook 2: 4.3, 5.5, 6.2, 7.2

MODULE-5	INTRODUCTION TO EMBEDDED SYSTEMS, COMMUNICATION SYSTEMS AND CELLULAR NETWORK	CO4 CO5 CO6	8 Hours

Embedded Systems: Definition of an Embedded System, Embedded systems vs General Purpose Systems, Application of Embedded Systems, Purpose of Embedded systems, Characteristics of Embedded systems

Communication Systems: Introduction to communication systems, Need for modulation, Principles of amplitude modulation, Introduction to angle modulation, FM and PM waveforms, Comparison of Analog Modulation Schemes, Amplitude shift keying, Frequency shift keying, Phase shift keying, Simplified block diagram of a digital radio system. Block diagram of GSM network.

Text Book	Textbook 3: 1.3, 1.4, 4.1, 4.2, 7.5, 9.3, 9.4, 9.5, Textbook 3: 19.3, 20.2, 20.4, 20.9.2, 9.1, Reference book 1: 1.1, 1.2, 1.5, 1.6, 3.1

CIE Assessment Pattern (50 Marks – Theory)

		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	10	5	
L2	Understand	10	10	5
L3	Apply	5		5
L4	Analyze			
L5	Evaluate			
L6	Create			

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	20
L4	Analyze	-
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Electronic Principles, Albert Malvino, David J. Bates, 7th Edition, 2017, McGraw Hill Education, ISBN : 978-0-07-337388.
2. Electronic Devices and Circuits, David. A. Bell, 5th edition, 2008, Oxford University Press, ISBN:978-0195693409.
3. Digital Logic and Computer Design, M. Morris Mano, 5th edition, 2002, PHI, ISBN:978-0131989269.
4. Electronic communication systems, Wayne Tomasi, 5th edition, 2001, Pearson education, ISBN:978-0130494924.

Reference Books:

1. Introduction to Embedded Systems, Shibu K. V., 1st Edition, McGraw Hill Education, 2009, ISBN:978-0070145894
2. Principles of Electronics, V. K. Mehta, 12th edition, 2020, S. Chand Publishing, ISBN:978-9352838277

Web links and Video Lectures (e-Resources):

- MOSFET: https://archive.nptel.ac.in/courses/108/106/108106105/
- Basic Electronics: https://nptel.ac.in/courses/122106025
- Embedded system: https://nptel.ac.in/courses/108102045
- https://www.youtube.com/watch7vHbGxhPG3H5BQhttps://it2.fiu.edu/mobile_computing/requiredreading/GSM%20Network%20Architecture%202.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Hands-On Component Identification
- Group Projects

Group activity to diagnose fault finding in basic simple electronic circuits.

ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING LAB			
Course Code	**25ECL141**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Demonstrate the characteristics of basic electronic components such as diodes, BJTs, and Zener diodes through practical experiments.
CO2	Implement and verify the working of basic rectifier and voltage regulator circuits to understand power conversion and regulation principles.
CO3	Design and test fundamental combinational and sequential logic circuits using basic logic gates, adders, subtractors, and flip-flops.
CO4	Simulate and analyze simple communication and embedded system-related experiments such as amplitude modulation and microcontroller-based timing operations.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	
25ECL141.1	3	2	-	-	2	-	-	-	-	1	1	
25ECL141.2	3	2	-	-	2	-	-	-	-	1	1	
25ECL141.3	3	3	3	2	2	-	-	-	-	1	1	
25ECL141.4	3	3	3	2	2	-	-	-	-	1	1	

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	PART-A		
1	VI Characteristics of a Diode	2	CO1, CO2
2	Full Wave Rectification	2	CO1, CO2
3	Full Wave Bridge Rectification	2	CO1, CO2
4	Zener Diode-Voltage Regulator	2	CO1, CO2
5	BJT Common Emitter Characteristics	2	CO1, CO2
6	Boolean Expressions using Basic Logic Gates	2	CO3
7	De Morgan's theorem using Logic Gates	2	CO3
8	Arithmetic Expressions using Adders / Subtractors	2	CO3
9	Sequential Circuits using Basic Flip-Flops	2	CO3
	PART-B (OPEN-ENDED EXPERIMENTS)		
10	Design and test a MOSFET to obtain Transfer and Drain Characteristics in Common Source Configuration	2	CO1, CO2
11	Programming for delay generation and the effect of the CPU clock	2	CO1, CO2
12	Amplitude Modulation simulation for given specifications	2	CO4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)
1. RC Frequency Response https://be-iitkgp.vlabs.ac.in/exp/differentiator-integrator/
2. RC Differentiator and Integrator https://be-iitkgp.vlabs.ac.in/exp/differentiator-integrator/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	5	5
L2	Understand	10	5
L3	Apply	5	10
L4	Analyze	5	5
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Electronic Principles, Albert Malvino, David J. Bates, 7th Edition, 2017, McGraw Hill Education, ISBN : 978-0-07-337388.
2. Electronic Devices and Circuits, David. A. Bell, 5th edition, 2008, Oxford University Press, ISBN:978-0195693409.
3. Digital Logic and Computer Design, M. Morris Mano, 5th edition, 2002, PHI, ISBN:978-0131989269.
4. Electronic communication systems, Wayne Tomasi, 5th edition, 2001, Pearson education, ISBN:978-0130494924.

Reference Books:

1. Introduction to Embedded Systems, Shibu K. V., 1st Edition, McGraw Hill Education, 2009, ISBN:978-0070145894
2. Principles of Electronics, V. K. Mehta, 12th edition, 2020, S. Chand Publishing, ISBN:978-9352838277

Learning Resources:

- MOSFET: https://archive.nptel.ac.in/courses/108/106/108106105/
- Basic Electronics: https://nptel.ac.in/courses/122106025
- Embedded system: https://nptel.ac.in/courses/108102045
- https://www.youtube.com/watch7vHbGxhPG3H5BQ
- https://it2.fiu.edu/mobile_computing/requiredreading/GSM%20Network%20Architecture%202.pdf

ELEMENTS OF ELECTRICAL ENGINEERING			
course code	**25EEE142**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**4**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principle of operation, components, layout, environmental and social issues of various power plants.
CO2	Recognize the energy properties of electric elements and the techniques to measure voltage and current.
CO3	Analyze the active and passive elements and performance parameters of ac circuits.
CO4	Choose the proper type and specification of measuring procedure and instruments for different industrial, commercial, and domestic applications.
CO5	Evaluate the basic operation and performance of electrical machines and can select appropriate machine for different purposes.
CO6	Use the concepts of tariff and different safety measures of electrical appliances.

Mapping of course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	1	2	-	-	-	-	-	-
CO3	3	1	-	1	2	-	-	-	-	-	-
CO4	3	-	-	-	1	-	-	-	-	-	-
CO5	2	1	-	1	2	-	-	-	-	-	-
CO6	2	1	-	1	1	-	-	-	-	-	-

MODULE-1	**POWER PLANTS AND DC CIRCUITS**	**CO1,CO2**	**8 Hours**

Power Generation:
Renewable and Non-Renewable energy resources - Hydel, Nuclear, Solar & wind power generation (Block Diagram approach) - Electrical power system structure-Single line diagram.

DC Circuits:
Ohm's Law and its limitations- KCL & KVL-series, parallel, series-parallel circuits-Simple Numerical

Text Book	Text Book 1: Chapter 1,2 & 3, Chapter 15 Text Book 5: Chapter 17, 1 & 2
Self-Study	A case study of the power sector in India

MODULE-2	**AC CIRCUITS**	**CO3**	**8 Hours**

A.C. Fundamentals:
Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor (only definitions)-Voltage and current relationship with phasor diagrams in R, L, and C Circuits- Series R-L, R-C, R-L-C circuits, concept of impedance and admittance, concept of active, reactive, apparent, complex power and power factor

Three Phase Circuits:
Three phase AC quantity, advantages, and limitations-star and delta connection-relationship between line and phase quantities.

Text Book	Text Book 1: Chapter 7,8 & 9
Self-Study	AC Electrical Circuit Analysis- Watching NPTEL video lecture series and Identification of phase, Neutral and Earth wires for connection

MODULE-3	**ELECTRICAL MEASUREMENTS AND WIRING**	**CO4**	**8 Hours**

Measurement and Instrumentation:
Functional elements of measuring instruments – Types of measuring instruments – Standards, Errors, and calibration-construction and working Principle of Permanent magnet moving coil and moving iron instruments-Attraction type, Single phase wattmeter and Single-phase energy meter and digital meters.

Domestic Wiring:
Requirements, Types of wiring: Two way and three-way control of lamp.

Text Book	Text Book 1: Chapter 13; Text Book 4: Chapter 15; Text Book 3: Chapter 1,2

Self-study	Study of electrical safety measures and protective devices and Identification of phase, Neutral and Earth wires for connection		
MODULE-4	**ELECTRICAL MACHINES**	**CO5**	**8 Hours**

DC Generator:
Principle of operation-constructional details, types-induced EMF expression.
DC Motor:
Principle of operation, back emf and its significance- Torque equation, types of motors, Applications of DC machines.
Transformers:
Principle of operation, construction of single-phase transformers, Types, EMF equation and losses in transformer, Definition of regulation and efficiency.

Text Book	Text Book 1: Chapter 10,11 & 12; Text Book 2: Chapter 9 & 10
Self-study	Watching NPTEL video lecture on Electrical Machines and Magnetic circuits

MODULE-5	**TARIFF CALCULATION AND ELECTRICAL SAFETY**	**CO6**	**8 Hours**

Energy conservation and load calculation:
Energy conservation and its necessity-Power rating and load calculations of domestic appliances -tariff and its types.
Equipment Safety measures:
Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits, Personal safety measures -Electric Shock, Earthing and its types, Safety Precautions to avoid shock. An over view of electric vehicles - block diagram approach.

Text Book	Text Book 1:782-796
Self-study	Case study on Electrical safety measures

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	5	3
L2	Understand	5	5	2
L3	Apply	5	5	5
L4	Analyze	-	-	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	20
L2	Understand	20
L3	Apply	10
L4	Analyze	--
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

TEXTBOOKS:

1) Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, 2nd Edition 2019, ISBN-13: 978-9353167219
2) Principles of Electrical Engineering and Electronics, V.K. Mehta, S Chand Publishing, 2019, ISBN: ISBN: 9788121942980
3) Electrical and electronic measurements and instrumentation by A K Sawhney, Dhanpat Rai & co. (P) Limited,2015, ISBn-10: 8177001000, ISBN-13: 978-8177001006
4) Basic Electrical and Electronics Engineering, D P Kothari, I J Nagrath, Second Edition, McGraw Hill Publishers, 2020, ISBN-10: 9389811244, ISBN-13: 978-9389811247

REFERENCE BOOKS:

3) Basic Electrical and Electronics Engineering, S.K. Bhattacharya, Pearson Education, 2017, ISBN: 9789332586505
4) A textbook of Electrical Technology by B.L. Theraja, S Chand Publication, 2014, ISBN: 8121924413

Web links and Video Lectures (e-Resources):

6. AC and DC circuits: https://www.youtube.com/watch?v=ERIToctYUcQ
7. Basic Concepts and examples: https://youtube/3TR_DS_7z2w
8. Ohm's Law, KVL, KCL : https://youtube/FjaJEo7knF4
9. Electrical measurements and instrumentation: https://www.youtube.com/watch?v=xLjk5DrScEU&list=PLt5syl71JKf3yk9h0mWg6vCNn1Jmb72JJ
10. Electrical machines: https://www.youtube.com/watch?v=KUSBS11qpX0&list=PLohtAIfLLw8cdi1iOLyLNX1f839KSXDnl

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on different topics
- Problem solving approach
- Collaborative learning
- Seminars
- Experiential learning approach through lab sessions (Hardware/Software)

ELEMENTS OF ELECTRICAL ENGINEERING LAB

Course Code	**25EEL142**	**CIE Marks**	**50**
L: T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

CO1	Apply fundamental electrical laws and principles to analyze and verify DC and AC circuits experimentally.
C02	Perform accurate measurements of electrical quantities such as voltage, current, power, power factor, and speed using standard instruments and evaluate performance characteristics of machines and circuits.
CO3	Interpret experimental results to identify errors, validate theoretical calculations, and suggest improvements in circuit design.
C04	Conduct experiments on electrical machines, wiring, and protection systems to demonstrate practical operational skills and verify real-time system performance.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	3	-	-	-	-	2	-	-
C02	-	-	-	3	3	-	-	-	2	-	-
CO3	-	3	-	3	-	3	-	-	2	-	-
C04	-	-	3	3	3	-	-	-	2	-	-

Exp. No.	**List of Experiments** ***Lab Assessment must have 15 marks from Part A and 10 marks from Part B**	**Hours**	**COs**
	Prerequisite Experiments		
	Study of ammeter, voltmeter, multimeter, potentiometer and calculation of resistance values	2	NA
	PART-A **(CONVENTIONAL EXPERIMENTS)**		
1	Verification of Ohm's Law	2	CO1, CO2
2	Verification of Kirchhoff's voltage law and Kirchhoff's current law	2	CO1, CO2
3	Measurement of voltage, current, resistance, impedance, power factor and power in an AC Circuit	2	CO1, CO2
4	Speed control of a DC shunt motor using armature control and field control.	2	CO2, CO4
5	Load test on a DC shunt motor	2	CO2, CO4
6	Load test on a single-phase transformer	2	CO2, CO4
7	Measurement of three-phase power using the Two-Wattmeter method	2	CO3, CO4
8	Staircase wiring for Two-way control of lamp	2	CO3, CO4
9	Fluorescent lamp wiring	2	CO3, CO4
	PART-B **(OPEN-ENDED EXPERIMENTS)**		
10	Analysis of equivalent resistance for different series-parallel configurations	2	CO1, CO2
11	Investigation of network simplification using star-delta conversion	2	CO1, CO2
12	Exploring the protective characteristics of Fuses and MCB	2	CO3, CO4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

1.Verification of Ohm's law- https://be-iitkgp.vlabs.ac.in/exp/ohm-law/index.html
2. Verification of Kirchhoff voltage and current Law - https://bes-iitr.vlabs.ac.in/exp/kirchhoff-law/
3.Analysis of a series R-L-C circuit- https://asnm-iitkgp.vlabs.ac.in/exp/rlc-circuit-analysis/
4.Three phase power measurement by two wattmeter method- https://asnm-iitkgp.vlabs.ac.in/exp/three-phase-power-measurement/
5.Calibration and Testing of Single-Phase Energy Meter- https://elms-iitr.vlabs.ac.in/exp/energy-meter/
6.Power Measurement using dynamometer - https://ic-coep.vlabs.ac.in/exp/power-measurement-dynamometer/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	10
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	20
L4	Analyze	-
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:
Reference Books:

1) Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, 2nd Edition 2019, ISBN-13: 978-9353167219
2) Principles of Electrical Engineering and Electronics, V.K. Mehta, S Chand Publishing, 2019, ISBN: ISBN: 9788121942980
3) Electrical and electronic measurements and instrumentation by A K Sawhney, Dhanpat Rai & co. (P) Limited,2015, ISBn-10: 8177001000, ISBN-13: 978-8177001006
4) Basic Electrical and Electronics Engineering, D P Kothari, I J Nagrath, Second Edition, McGraw Hill Publishers, 2020, ISBN-10: 9389811244, ISBN-13: 978-9389811247

ELEMENTS OF MECHANICAL ENGINEERING			
Course Code	**25MEE143**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**04**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

CO1	Analyse the different Engineering Materials along with their applications
CO2	Illustrate the basic concepts of internal combustion engine vehicles
CO3	Demonstrate the working and operations of machine tools and metal joining techniques
CO4	Excel the basic lead through programming of robots
CO5	Apply the concepts of belt and gear drives to solve basic numerical problems related to velocity ratio in gear drives
CO6	Discuss the role of computer systems in manufacturing, their contribution to automation, and the applications of 3D printing and AI in mechanical engineering

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	`
CO4	3	3	2	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-

MODULE-1	**ENGINEERING MATERIALS**	**CO1**	**8 Hours**

Introduction, Classification, Ferrous and Non-Ferrous metals: Types, Properties and their applications. Composite materials: Introduction, Constituents of a composite, Classification, Types of Matrix and Reinforcement materials, Advantages, Disadvantages and Applications of composite materials in Aerospace and Automobile industries.

Smart materials: Introduction, Types - Piezoelectric materials, MR fluids, Shape memory alloys and Advantages, Disadvantages and Applications

Case study	Case Studies on Performance different Boilers
Text Book	Text Book 1: ch 1.1,1.2,1.3,1.4,1.5,1.6,1.7

MODULE-2	**STEAM & IC ENGINES**	**CO2**	**8 Hours**

Formation of steam, properties of steam, numericals related to steam properties. Introduction to heat engines and heat pumps: Working principle of Two stroke and Four stroke engines (SI & CI Engines), simple numericals.

Applications	Simulation and Virtual Labs
Text Book	Text Book 2: Ch.3.1,3.2,3.3,3.4,3.5,3.6,3.7

MODULE-3	**MACHINE TOOLS & METAL JOINING**	**CO3**	**8 Hours**

Lathe: Working principle, Specifications, Operations performed – Turning, Facing, Taper turning by swivelling the compound rest, Thread cutting and Knurling.

Drilling Machine: Working principle, Specifications, Operations performed – Drilling, Reaming, Boring, Counter boring, Countersinking, And Tapping. (Sketches of machine tools not required. Sketches to be used only for explaining the operations).

Joining Processes: Introduction, Temporary and Permanent joining methods: Working principle of Soldering, Brazing and Electric Arc welding, Advantages, Limitations and Applications 3D Printing Technologies

Case Study	Partial Delivery of course by Industry experts
Text Book	Text Book 2-Ch.-4.1,4.2,4.3,4.4,4.5,5.1,5.2,5.3,5.4, Text Book 4: Ch 1.1,1.2,1.3,2.1,2.2,2.3,3.1,3.2,3.3

MODULE-4	**TRANSMISSION AND DRIVE SYSTEMS**	**CO5**	**8 Hours**

Belt drives: Introduction, Open and Cross belt drives, Flat belts and V belts, simple numericals.

Gear Drives: Types of Gears, Velocity ratio, Gear Trains - Simple and Compound gear trains, simple numericals

Self Study	Video demonstration

Text Book	Text Book 2-Ch.-4.6,4.7,4.8, Text book 3-Ch 6.1,6.2,6.3,6.4		
MODULE-5	**INDUSTRIAL AUTOMATION**	**CO4, CO6**	**8 Hours**
Robot lead through programming, Part presentation method, assembly operations, assembly cell design, designing for robot assembly, inspection automation, and coding, operations of preparatory codes (G codes) and miscellaneous codes (M codes) part programming deployment and demonstration Applications of AI in Mechanical Engineering: Automobile industry, manufacturing industry and Mechanical design.			
Self study	Visit to Advanced Manufacturing lab, Visit to Robotics lab		
Text Book	Text Book 3: 14.1,14.2,18.1,18.2,18.3,18.4,20.1,20.2,20.3,20.4		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	10	5	5
L4	Analyze	5	5	5
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

Text Books:

1. I P Singh, Material Science & Engineering, Jain Brothers publications, 14th Ed, 2021, ISBN 978-8183600958
2. Kestoor Praveen, M R Ramesh, Elements of Mechanical Engineering, Suggi Publishers, 2nd Ed, 2016, ISBN555-1234003176
3. Groover. M.P. Industrial Robotics, technology, programming, and application, Mc-Graw Hill, 2nd Ed, 2017, ISBN978-1259006210
4. Ian Gibson, David. W. Rosen, Brent Stucker, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer, 2nd Ed, 2014, ISBN978-1493921126

Reference Books:

1. K R Gopala Krishna, Elements of Mechanical Engineering, Subhash Publications, 38th Ed, 2018, ISBN555-1234106005.
2. S K Hajra Choudhury and Nirjhar Roy, Elements of Workshop Technology (Vol. I and II), Media Promoters and Publishers Pvt. Ltd., 15th Ed, 2016. ISBN978-8185099146,156
3. Ganeshan. V, Internal Combustion Engines, Tata McGraw Hill, 4th Ed, 2017. ISBN978- 1259006197
4. Rajput R.K, Thermal Engineering, Laxmi Publications (Pvt) Ltd., New Delhi. 11th Ed, 2020, ISBN978-8131808047.
5. Mikell P. Grover, Automation Production Systems and Computer Integrated Manufacturing, PHI, 5th Ed, 2024, ISBN 978-9361592959.
6. Husain Iqbal, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 3rd Edition, ISBN978-0849314667

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/112104526
- https://nptel.ac.in/courses/112104616
- https://nptel.ac.in/courses/112104769
- https://venturebeat.com/ai/how-ai-is-impacting-the-automotive-world/
- https://www.vlcsolutions.com/blog/artificial-intelligence-in-manufacturing/
- https://skill-lync.com/blogs/technical-blogs/design-applications-of-machine-learning-and-ai-in- mechanical-engineering
- https://caeassistant.com/blog/ai-in-mechanical-engineering-video/
- https://www.neuralconcept.com/post/how-is-ai-used-in-mechanical-engineering
- https://www.youtube.com/watch?v=MKiiXubKaGM
- https://www.youtube.com/watch?v=_canCYWZPsc

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstration of working of Robots
- Video demonstration of latest trends in Mechanical Engineering
- Contents related activities (Activity-based discussions)
- Flowcharts and Handout preparation by students
- Group Discussion Seminars

ELEMENTS OF MECHANICAL ENGINEERING LAB			
Course Code	**25MEL143**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Perform mechanical testing to determine material properties such as hardness and fuel characteristics.
CO2	Analyze microstructural features of materials using metallographic techniques.
CO3	Demonstrate the ability to operate conventional machine tools and perform basic manufacturing processes.
CO4	Develop and evaluate engineering components using sheet metal, gear measurement, and 3D printing techniques

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	1	-	-	-	-	-	-
CO2	3	2	2	-	2	-	-	-	-	-	-
CO3	2	2	1	2	2	-	-	-	-	-	-
CO4	3	2	2	3	3	-	-	-	-	-	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	NA	-	NA
	PART-A		
1	Determination of hardness number by Hardness measuring machine	2	CO1
2	Metallography investigation of a given specimen	2	CO1
3	Determination of flash & Fire points for a given fuel	2	CO2
4	Drawing of Valve time diagram for 4 stroke diesel Engine	2	CO2
5	Drawing of Port time diagram for 2 stroke petrol Engine	2	CO3
6	Preparation of Welding and soldering models	2	CO3
PART-B			
7	Performing facing and turning using lathe machine tool	2	CO1
8	Performing drilling operation using drilling machine	2	CO4
9	Measurement of gear tooth parameters using gear teeth vernier	2	CO2
10	Development of Sheet metal models for the irregular profiles	2	CO3
11	Development of a prototype for any irregular profile using 3D- Printing	2	CO2
12	Determination of area of irregular shapes using planimeter	2	CO1

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

- https://nptel.ac.in/courses/112104526
- https://nptel.ac.in/courses/112104616
- https://nptel.ac.in/courses/112104769
- https://venturebeat.com/ai/how-ai-is-impacting-the-automotive-world/
- https://www.vlcsolutions.com/blog/artificial-intelligence-in-manufacturing/
- https://skill-lync.com/blogs/technical-blogs/design-applications-of-machine-learning-and-ai-in- mechanical-engineering

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	10
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	05
L2	Understand	05
L3	Apply	20
L4	Analyze	20
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Reference Books:

5. P Singh, Material Science & Engineering, Jain Brothers publications, 14th Ed, 2021, ISBN 978-8183600958
6. Kestoor Praveen, M R Ramesh, Elements of Mechanical Engineering, Suggi Publishers, 2nd Ed, 2016, ISBN555-1234003176
7. Groover. M.P. Industrial Robotics, technology, programming, and application, Mc-Graw Hill, 2nd Ed, 2017, ISBN978-1259006210
8. Ian Gibson, David. W. Rosen, Brent Stucker, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer, 2nd Ed, 2014, ISBN978-1493921126

PROBLEM SOLVING USING PYTHON			
Course Code	**25CSE144**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs. / Week	**4**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the fundamental concepts of Python and Apply the basic programming skills of Python Language in problem-solving.
CO2	Implement Python programs using different datatypes, Control statements loops and user- defined functions.
CO3	Analyze different string manipulation functions available in Python.
CO4	Analyze Exception handling functions available in Python.
CO5	Apply List, set, dictionary and Tuple concepts to design a Python program.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-

MODULE-1	**BASICS OF PYTHON**	**CO1**	**8 Hours**

Algorithm and Flowchart, Elements of Python: Keywords, Identifiers, Variables, Data Types, Features. **Operators and Expression:** Assignment Statements, Numeric Expressions, Order of Evaluation, Operator Precedence, Type Conversions, Input Output Statement, Comments in Python.

Text Book	Textbook 1: 1.2

MODULE-2	**LOOPS ,CONTROL STATEMENTS AND FUNCTIONS**	**CO2**	**8 Hours**

Loops and Control Statements: If, elif, Nested if, for, nested for, while, continue, Break, Pass.
Functions: Advantage of Functions in Python, creating a Function, Function Calling, return statement, Arguments in function, Pass by Object Reference, Built-in Function, Lambda Functions, Map, Filter, Reduce functions, Recursive functions.

Text Book	Textbook 1: 1.3,1.5,1.6,1.7,2:2.4

MODULE-3	**STRINGS AND EXCEPTION HANDLING**	**CO3**	**8 Hours**

Strings: Creating String in Python, Strings indexing and splitting, Reassigning Strings, Deleting the String, String Operators, Python String functions, slice operations.
Assertion and Exception Handling: Assertion usage in Python, Exception handling, try, except, raise, finally.

Text Book	Textbook 1:1.5,1.8,2:2.8

MODULE-4	**LIST SET, DICTIONARY AND TUPLE**	**CO4**	**8 Hours**

List: Creating a List, List indexing and splitting, Python List Operations, List Built-in functions,
Tuple: Creating a tuple, Indexing, Deleting Tuple, Tuple operations, Tuple inbuilt functions.
Set: Creating a set, Python Set Operations, Python Built-in set methods.
Dictionary: Creating the dictionary, Properties of Keys and Values, Accessing the dictionary values, and adding dictionary values, Iterating Dictionary, Built in Dictionary functions.

Text Book	Textbook 1: 1.10,1.11,1.12,2:2.5

MODULE-5	**FILES AND OBJECT-ORIENTED PROGRAMMING**	**CO5**	**8 Hours**

Files: Text files, reading and writing files, format operator; command line arguments, modules, packages
Object Oriented Programming: – creating python classes – Initializing objects, Objects and classes - **Abstraction** – overview of inheritance and its type, polymorphism.

Text Book	Textbook 1:1.14 to 1.18,2:2.6,2.7,2.9

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test(s)	AAT1	AAT2
		25	15	10
L1	Remember	5	5	-
L2	Understand	5	5	5
L3	Apply	5	5	5
L4	Analyze	5	-	-
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Publisher: O'Reilly Publishers, 3rd Edition, 24 May 2024,ISBN: 978-109815543.
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2", Publisher: Network Theory Ltd., 2011, ISBN-10: 1636390471, ISBN-13: 978-1636390475

Reference Books:

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, Publisher: MIT Press, 2023.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter- disciplinary Approach", Publisher: Pearson India Education Services Pvt. Ltd., 2022.
3. Timothy A. Budd, "Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2021.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs, CENGAGE Learning, 2022.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2023.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3, Pragmatic Programmers, LLC, 2022.

Web links and Video Lectures (e-Resources):

1). https://www.python.org/
2). https://www.codecademy.com/learn/learn-python-3
3). https://pynative.com/
4). https://www.programiz.com/python-programming
5). https://learnpython.com/
6). https://alison.com/course/a-python-course-for-complete-beginners
7). https://www.coursera.org/learn/python
8). https://www.edx.org/learn/computer-science/massachusetts-institute-of-technology-introduction-to- computer-science-and-programming-using-python

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes for list, tuple, string dictionary slicing operations using below link
  - https://github.com/sushantkhara/Data-Structures-And-Algorithms-with-Python/raw/main/Python%203%20_%20400%20exercises%20and%20solutions%20for%20beginners.pdf

PROBLEM SOLVING USING PYTHON LAB			
Course Code	**25CSL144**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply Python fundamentals to solve computational and mathematical problems.
CO2	Demonstrate the use of iterative control structures, conditional statements, and string manipulation for problem-solving.
CO3	Implement operations on Python data structures and perform basic file-handling techniques for data management.
CO4	Apply user-defined functions, classes, and exception handling to design structured and efficient Python programs for real-world problem solving.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	1	-	-	-	-	-	**2**
CO2	2	2	2	2	1	-	-	-	-	-	2
CO3	2	2	2	2	1	-	-	-	-	-	2
CO4	2	2	2	2	1	-	-	-	-	-	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs		
	Basics of Programming	2	-
	PART-A **CONVENTIONAL PROGRAMS**		
1	Write a Python program that calculates the area of a. A circle based on the appropriate entered by the user. b. A triangle based on the appropriate entered by the user	2	CO1
2	Write a Python program a. To accept an integer (n) and computes the value of n+nn+nnn. b. To accept two integer numbers, return their product only if the product is equal to or lower than 1000. Otherwise, return their sum.	2	CO1
3	Write a Python program a. To create the multiplication table (from 1 to 10) of a number. **b.** To count the number of even and odd numbers in a series of numbers Sample numbers: numbers = (1, 2, 3, 4, 5, 6, 7, 8, 9)	2	CO1
4	Write a Program to Accept a Hyphen Separated Sequence of Words as Input and Print the Words in a Hyphen-Separated Sequence after Sorting them Alphabetically	2	CO2
5	Given a string in python, count number of uppercase letters, lowercase letters and spaces in a string and toggle case the given string (convert lowercase to uppercase and vice versa).	2	CO2
6	Write a Python script to add a key to a dictionary. Sample Dictionary: {0: 10, 1: 20}	2	CO2
	PART-B **OPEN-ENDED PROGRAMS**		
7	Write a Python program a. To remove an item from a set if it is present in the set. b. To find repeated items in a tuple	2	CO3
8	Write a Python program a. To count the number of lines in a text file b. To append text to a file and display the text	2	CO3

9	Write a Python program to generate 26 text files named A.txt, B.txt, and so on up to Z.txt	2	CO3
10	Develop a function named DivExp which takes TWO parameters a, b, and returns a value c (c=a/b). Write a suitable assertion for a>0 in the function DivExp and raise an exception for when b=0. Develop a suitable program that reads two console values and calls the function DivExp.	2	CO4
11	Define a function that takes TWO objects representing complex numbers and returns a new complex number with the sum of two complex numbers. Define a suitable class 'Complex' to represent the complex number. Develop a program to read N (N >=2) complex numbers and to compute the addition of N complex numbers.	2	CO4
12	Develop Student Grade Tracker: Accept multiple students' names and marks. Store them in a list of tuples or dictionaries. Display summary reports (average, topper, etc.).	2	CO4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. https://python-iiith.vlabs.ac.in/
2. https://labex.io/free-labs/python

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	5	10
L4	Analyze	10	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Publisher: O'Reilly Publishers, 3rd Edition, 24 May 2024, ISBN: 978-109815543.
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2", Publisher: Network Theory Ltd., 2011, ISBN-10: 1636390471, ISBN-13: 978-1636390475

Reference Books:

3. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, Publisher: MIT Press, 2023.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Publisher: Pearson India Education Services Pvt. Ltd., 2022.
5. Timothy A. Budd, "Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2021.
6. Kenneth A. Lambert, "Fundamentals of Python: First Programs, CENGAGE Learning, 2022.
7. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2023.
8. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3, Pragmatic Programmers, LLC, 2022.

PROGRAM LANGUAGE COURSE (PLC)

PROGRAMMING IN C			
Course Code	**25PLC24**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the fundamentals of programming paradigms and the basic structure of C programs.
CO2	Demonstrate decision-making and looping constructs to solve computational problems.
CO3	Apply the concepts of arrays and strings for efficient data representation and manipulation.
CO4	Examine modular programming concepts using functions, recursion, and pointers.
CO5	Analyze structures and unions with respect to memory allocation and data organization.
CO6	Apply sorting and file handling techniques for effective data processing.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	-	-	-	-	-	-	**2**
CO2	3	3	2	2	-	-	-	-	-	-	**2**
CO3	3	2	2	2	-	-	-	-	-	-	**2**
CO4	3	3	3	2	-	-	-	-	-	-	**2**
CO5	3	2	2	2	-	-	-	-	-	-	**2**
CO6	3	3	2	2	-	-	-	-	-	-	**2**

MODULE-1	**BASICS OF C PROGRAMMING**	**CO1, CO2**	**8 Hours**

Introduction to programming paradigms, Structure of C program; Data Types; variables; constants; Operators, formatted Input / Output statements; Decision making and branching statements, Type conversion and Type casting, Looping statements: for, while, do-while, nested for loop. break, continue and go to statement.

Textbook	Textbook 1: 1.1, 1.2, 1.3 to 1.5

MODULE-2	**ARRAYS AND STRINGS**	**CO3**	**8 Hours**

Single dimensional array: Declaration, Initialization, reading and printing array, Two dimensional arrays: Declaration, Initialization; Strings: Declaring, Initializing, Printing and reading strings, String input and output

functions, String handling functions, Arrays of strings.

Textbook	Textbook 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	**FUNCTIONS AND POINTERS**	**CO4**	**8 Hours**

Function: User defined functions- function definition, function declaration, function call, Formal and actual parameters, Categories of functions, **Recursion**: Factorial, Fibonacci series**, Pointers**: Introduction to pointers, declaring pointer variables, Types of pointers, Pointer arithmetic, Parameter Passing: Pass by value, Pass by reference.

Textbook	Textbook 2: 3.1, 3.3, 3.5, 3.7, 3.10

MODULE-4	**STRUCTURES AND UNION**	**CO5**	**8 Hours**

Structure: Basics of structures – Creating a Structure, Accessing Structure Members, Memory Allocation, Nested Structures, Array of structures, Arrays within Structures, Self-referential structures.Union: Declaration, Accessing Union Members, Memory Allocation

Textbook	Textbook 1: 6.1, 6.3, 6.5, 6.7, Textbook 2: 10.1, 10.3, 10.5, 10.7

MODULE-5	**SORTING AND FILE PROCESSING**	**CO6**	**8 Hours**

Bubble sort, Selection Sort, Insertion Sort, Files – Introduction to files, creating a file, file pointer, Modes of a file, Opening and closing the files, Input and output operations on Files.

Textbook	Textbook 2: 12.1 to 12.10

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	5	-
L2	Understand	5	5	5
L3	Apply	5	5	5
L4	Analyze	5	-	-
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978- 93 8728-449-4.
2. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.

Reference Books:

1. Ashok N. Kamthane, "Programming In C",3rd edition, Pearson, ISBN 978-933254-355-3.
2. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016, ISBN: 978-01 9945-614-7

Web links and Video Lectures (e-Resources):

1. http://elearning.vtu.ac.in/econtent/courses/video/BS/14CPL16.html
2. https://nptel.ac.in/courses/106/105/106105171/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Peer Teaching:** The students can be asked to teach and discuss specific topic or concept to their peers. This not only reinforces their own understanding but also encourages active engagement and collaboration.
- **Reflection and Discussion:** The students can be asked to present their learning of any topic with others. This will encourage students to reflect on their experiences and discuss what they learned. This promotes critical thinking and deeper understanding.
- **Tricky Programs:** Tricky programs that can improve student's logical knowledge to solve complex problems with different methods. They can be individual or team-based.

PROGRAMMING IN C LAB			
Course Code	**25PCL24**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

CO1	Understand the fundamental programming constructs such as decision-making and looping to solve computational problems.
CO2	Demonstrate programs using arrays and strings for effective data manipulation and processing.
CO3	Examine pointers, functions, and recursion to design modular programs.
CO4	Analyze structures, sorting algorithms, and file handling techniques for efficient organization and management of data.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	-	-	-	-	-	**2**
CO2	3	3	2	2	1	-	-	-	-	-	2
CO3	3	2	2	2	1	-	-	-	-	-	2
CO4	3	3	2	2	1	-	-	-	-	-	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs		
	Basics of Programming	2	-
	PART-A **CONVENTIONAL PROGRAMS**		
1	Write a C program to compute roots of quadratic equation ax2+bx+c=0, where a, b, and c are three coefficients of a quadratic equation as inputs.	2	CO1
2	Write a C program to implement a simple arithmetic calculator using a switch-case statement.	2	CO1
3	Write a C Program to compute Sin(x) using Taylor series approximation given by Sin(x) = x - (x3/3!) + (x5/5!) - (x7/7!) + …….	2	CO1
4	Write a C program to demonstrate the following: 1. Print all Armstrong numbers between 1 and N (where N is user input). 2. Print reverse of a given number	2	CO1
5	Write a C program to Merge Two Arrays and print the resultant array.	2	CO2
6	Design and develop a C program to read two matrices and print a multiplication of a matrix.	2	CO2
	PART-B **OPEN-ENDED PROGRAMS**		
7	Design a C program to check if a keyword is present in a document title without using standard library functions. Modify the solution to handle case-insensitive searches.	2	CO2
8	Develop a C program using a recursive function to generate the Fibonacci sequence up to n terms. Extend your program to handle invalid inputs.	2	CO3
9	A research lab collects N real-time temperature readings from sensors. To analyze this data, they need the sum, mean, and standard deviation of the readings. Develop a C program using pointers to compute and display these values. Identify and report temperature readings that significantly deviate from the calculated mean.	2	CO3
10	A university stores student records including Name, USN, and marks in 3 courses. To identify the best student, the system must calculate the average marks of each student and display the details of the one with the highest average. Develop a C program using	2	CO4

	structures to perform this task. Include functionality to identify students who have failed in one or more courses and display their details separately.		
11	An exam controller has a list of students' marks that need to be arranged in order for ranking purposes. Develop a C program to sort numbers using the Bubble Sort algorithm. Extend the program to highlight participants who scored below 40, marking them as "Needs Improvement**".**	2	CO4
12	An archive system maintains text files containing old manuscripts. To analyze the content, the system must count the total number of lines, words, and characters. Develop a C program to read a file and generate these counts. Design your program to also report: the most frequently used word in the file.	2	CO4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html
2. https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	-	5
L3	**Apply**	5	10
L4	**Analyze**	10	10
L5	**Evaluate**	5	5
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Text Books:

1. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978- 93 8728-449-4.
2. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.

Reference Books:

1. Ashok N. Kamthane, "Programming In C",3rd edition, Pearson, ISBN 978-933254-355-3.
2. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016, ISBN: 978-01 9945-614-7

EMERGING TECHNOLOGY COURSE (ETC I & II)

INTRODUCTION TO AI AND APPLICATIONS			
Course Code	**25ETC15/25**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Explain the concepts and types of artificial intelligence.
CO2	Make use of prompt engineering techniques
CO3	Explain the concepts of creative thinking and effective writing using prompt engineering
CO4	Implement ethics in artificial intelligence.
CO5	Outline recent trends in artificial intelligence.
CO6	Identify real-world applications across different disciplines.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-
CO6	2	1	-	-	-	-	-	-	-	-	-

MODULE-1	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**	CO1	**8 Hours**

Introduction to Artificial Intelligence: Working of Artificial Intelligence, Advantages and Disadvantages of Artificial Intelligence, Evolution of Artificial Intelligence, Types of Artificial Intelligence, Weak AI, Strong AI, Reactive Machines, Theory of Mind, Self-Awareness, Is Artificial Intelligence Same as Augmented Intelligence and Cognitive Computing
Machine Intelligence: Defining Intelligence, Components of Intelligence, Differences Between Human and Machine Intelligence, Knowledge Representation and its types, Knowledge Representation and its types.

MODULE-2	**INTRODUCTION TO PROMPT ENGINEERING**	CO2	**8 Hours**

Introduction to Prompt Engineering: Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work, Comprehending Prompt Engineering's Function in Communication, The Advantages of Prompt Engineering, The Future of LLM Communication
Prompts for Creative Thinking and Effective Writing: Unlocking Imagination and Innovation, Brainstorming Prompts for Problem Solving, Inspiring Prompts for Artistic Expression, Igniting the Writing Process with Prompts, Prompts for Overcoming Writer's Block, Prompts for Developing Narrative Skills

MODULE-3	**PROMPT ENGINEERING TECHNIQUES**	CO3	**8 Hours**

Prompt Engineering techniques using ChatGPT and GEMINI AI and META AI: Introduction to Prompt Engineering Techniques, Instructions Prompt Technique, Zero, One, and Few Shot Prompting, Self-Consistency Prompt, Prompt Gallery
Introduction to ChatGPT: Introduction to ChatGPT, A Concise History: From GPT-1 to GPT-4, How to Install and Configure ChatGPT

MODULE-4	**ETHICS AND TRENDS IN AI**	CO4,5	**8 Hours**

Ethics and Trends in AI: Ethical Concerns like Privacy, sustainability, reliability and Bias, AI as a Service (AIaaS), Recent trends in AI, Expert System, Internet of Things, Artificial Intelligence of Things (AIoT)

MODULE-5	**INDUSTRIAL APPLICATIONS OF AI**	CO6	**8 Hours**

Industrial Applications of AI: Application of AI in Healthcare, Application of AI in Finance, Application of AI in Retail, Application of AI in Agriculture, Application of AI in Education, Application of AI in Transportation, AI in Experimentation and Multi-disciplinary research, Robotics-an Application of AI, Drones Using AI

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Reema Thareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023.
2. Ajantha Devi Vairamani and Anand Nayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI: https://doi.org/10.1201/9781032692319).
3. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, "AI for Everyone – A Beginner's Handbook for Artificial Intelligence", Pearson, 2024.

Reference Books

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach* (4th Edition), Pearson Education, 2023.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, *Artificial Intelligence*, McGraw Hill Education.
3. Tom Taulli, *Prompt Engineering for Generative AI: ChatGPT, LLMs, and Beyond*, Apress, Springer Nature.
4. Nilakshi Jain, Artificial Intelligence: Making A System Intelligent, First Edition, Wiley.

Web links and Video Lectures (e-Resources):

- Elements of AI – *https://www.elementsofai.com*
- CS50's Introduction to Artificial Intelligence with Python – Harvard *https://cs50.harvard.edu/ai/*
- Google Machine Learning Crash Course – *https://developers.google.com/machine-learning/crash-course*
- Learn Prompting (Open-Source Guide) –
- Google AI – Learn with Google AI *https://ai.google/education/*
- Coursera – Machine Learning by Andrew Ng (Stanford University) *https://www.coursera.org/learn/machine-learning*
- OpenAI Prompt Engineering Guide (for ChatGPT) *https://platform.openai.com/docs/guides/gpt-best-practices*
- Prompt Engineering for Developers – DeepLearning.AI + OpenAI *https://www.deeplearning.ai/short-courses/chatgpt-prompt-engineering-for-developers/*
- Ethics in AI – Google Responsible AI Practices *https://ai.google/responsibilities/responsible-ai-practices/*
- Google Teachable Machine (Train AI models visually without code) *https://teachablemachine.withgoogle.com*

HUMANITIES / ABILITY ENHANCMENT / NCMC COURSES

AI-POWERED COMMUNICATIVE ENGLISH											
Course Code			26ENG16/26						CIE Marks		50
L:T:P:S			0:0:1:0						SEE Marks		50
Hrs/Week			2						Total Marks		100
Credits			01						Exam Hours		3hrs
Course outcomes: At the end of the course, the student will be able to:											
C01	Demonstrate effective verbal, non-verbal, and interpersonal communication skills in academic and professional contexts.										
CO2	Apply phonetic principles, pronunciation, stress, and intonation for effective oral communication.										
CO3	Apply appropriate grammar and language structures for effective communication.										
CO4	Utilize grammar concepts and AI-enabled tools to enhance oral and written communication.										
CO5	Deliver well-organized presentations using appropriate presentation techniques and visual aids.										
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
C01									1	3	2
CO2										3	2
CO3										3	2
CO4									1	3	2
CO5									1	3	2
MODULE 1			**Foundations of Communication**						**CO1**		**3 Hours**
Glimpses of Essential English for Engineers (General Overview), Fundamentals of Communicative English, Process of Communication, Barriers to Effective Communicative English, Different styles and levels in Communicative English (Communication Channels).											
Activity			Role play, Icebreaker Exercises, Formal and Informal Communication Scenarios & Non-verbal Communication Activities.								
Language Laboratory			Quiklrn platform for Listening, Speaking, and Pronunciation Practice.								
MODULE 2			**Phonetics and Pronunciation**						**CO2**		**3 Hours**
Introduction to Phonetics, Speech Sounds and Pronunciation. Stress, Rhythm, and Intonation. Mother Tongue Influence and Methods to minimize MTI.											
Activity			Pronunciation Drills, Role Plays in Workplace Contexts, Self-Introduction and Professional Introduction, Intonation and Fluency Exercises.								
Language Laboratory			Quiklrn platform for Listening, Speaking, and Pronunciation Practice.								
MODULE 3			**Grammar for Communication – Part I**						**CO3&4**		**3 Hours**
Basic English Grammar and Parts of Speech - Nouns, Pronouns, Adjectives, Verbs, Adverbs, Conjunctions, Articles and Preposition. Introduction to Subject–Verb Agreement, Basic rules and common errors,											
Activity			Error Correction Exercises, Sentence Construction Activities, Dialogue Creation, Grammar-Based Communication Tasks.								
Language Laboratory			Quiklrn for Interactive Sentence-Building and Speaking Activities.								
MODULE 4			**Grammar for Communication – Part II**						**CO3&4**		**3 Hours**
Introduction to Tenses, Types, Common Errors in the Use of Tenses, Tenses in Everyday and Professional Communication, Introduction to Direct and Indirect Speech, Rules for Changing Direct to Indirect Speech, Direct and Indirect Speech in workplace Communication.											
Activity			Grammar Games, AI-Assisted Grammar Practice, Role Plays Using Target Grammar, Conversation and Storytelling Activities								
Language Laboratory			Quiklrn Grammar and Speaking Activities								
MODULE-5			**Presentation Skills and Professional Communication**						**CO1&5**		**3 Hours**
Introduction to Definition and Process of Communication- Idea generation techniques, Organizing a speech - preparation, practice, delivery, Extempore Speech, Delivering presentations, Presentation techniques - Creating Visual Support, presenting with audio and visual aids.											

Activity	Individual Presentations, Presentation Delivery Using Visual Aids		

CIE Assessment Pattern (50 Marks - Theory/MCQ)

RBT Levels		Marks Distribution	
		Test(s)	Alternative assessment(s)
		25	25
L1	Remember	-	5
L2	Understand	5	5
L3	Apply	10	10
L4	Analyze	10	5
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Viva Voce)

RBT Levels		Exam Marks Distribution
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

TEXT BOOKS:

1. Communication Skills by Sanjay Kumar & Pushp Lata, Oxford University Press India Pvt Ltd - 2019
2. A Textbook of English Language Communication Skills, (ISBN-978-81-955465-2-7), Published by Infinite Learning Solutions, Bengaluru - 2022
3. A Final Course of Grammar & Composition - PC Wren & H. Martin by S Chand.
4. Raman, Meenakshi & Sharma, Sangeeta. *Technical Communication: Principles and Practice. Oxford University Press.*

Activity-Based Learning (Suggested Activities in Class)/ Practical Based **learning**

- Participate in role plays and presentations
- Watch TEDx videos and review
- POD Casts Sessions
- Participate in JAM sessions
- Actively participate in Group Discussions.
- Use every opportunity in the class to communicate.

CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS			
Course Code	**25CIP17/27**	**CIE Marks**	**100**
L: T:P:S	**0:0:0:0**	**SEE Marks**	**-**
Hrs. / Week	**1**	**Total Marks**	**100**
Credits	**PP**	**Exam Hours**	**-**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the historical background, key influences, and foundational structure of the Indian Constitution.
CO2	Analyze the Fundamental Rights, Duties, and the Directive Principles of State Policy, including their implementation and significance.
CO3	Explain the structure, powers, and functions of the Union and State governments, including the roles of the Executive, Legislature, and Judiciary.
CO4	Comprehend the importance of professional ethics in Engineering, including social responsibility, sustainable development, and workplace ethics.
CO5	Understand Cyber Laws and the IT Act 2000 and analyze the landmark judgements.

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	2	-	-	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-
CO4	-	-	-	-	-	2	3	-	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-

MODULE-1	**INTRODUCTION TO CONSTITUTION OF INDIA**	**CO1**	**3 Hours**

Historical Background and Making of the Constitution, the preamble of the Indian Constitution, its significance, the role of the Constituent Assembly, Analyze the Fundamental Rights with certain case studies, Duties and the Directive Principles of State Policy, including their implementation and significance

Self-study / Case Study / Applications	Seminar on: • Is democracy the best form of government? • Duty of Union Government towards State Government. • Gender Equality & Law. • Present Status of Women in India.
Text Book	1

MODULE-2	**UNION EXECUTIVE & STATE EXECUTIVE**	**CO2**	**3 Hours**

Composition and function of Union & State Executive, Judicial activism as well as judicial review, Significant terms used in Parliament, powers and functions of Supreme Court, Public Interest Litigation (PIL) Power & Function of Subordinate Court and High Court. State Advocate General, State Controller and Auditor General, Comptroller & Auditor General of India.

Self-study / Case Study / Applications	Seminar on: • Why is the number of women's position in politics still low? • Position of President in Parliamentary system of Government. • Juvenile justice: a comparison across different countries. • "Women's Rights and Gender Equality in Indian Law".
Text Book	1

MODULE-3	**AMENDMENTS AND PROCEDURE, ELECTION COMMISSION & EMERGENCY PROVISIONS:**	**CO3**	**3 Hours**

Election laws, Electoral process and the Election Commission of India. Types and Significance of Amendments to the Constitution. Emergency Provisions, types of Emergencies and its consequences.

Self-study / Case Study / Applications	Seminar on: • Election Commission and its importance for vibrant Democracy. • Independence of Judiciary vis a vis Basic Structure Doctrine, Judicial Accountability. • Recent Developments in Respects to Judicial Appointments.
Text Book	1

MODULE-4	**ETHICS AND PROFESSIONALISM IN ENGINEERING.**	**CO4**	**3 Hours**

Introduction to Professional Ethics: Definition and importance of professional ethics. Codes of ethics for Engineers. Case studies on ethical dilemmas.Engineers' Responsibility to Society: Responsibility of Engineers, Impediments to responsibility. Clash of ethics. Ethics in Engineering Practice: Workplace ethics: honesty, integrity, and transparency. Conflicts of interest and whistle blowing. Case studies on workplace ethics

Self-study / Case Study / Applications	Seminar on: • Engineers and Society. • The role of ethics in professional practice. • The importance of professional ethics in developing trust and respect in the workplace. The Importance of Ethics in Engineering.
Text Book	2, 3 &4

MODULE-5	**Cyber Law and Cyber Crimes**	**CO5**	**3 Hours**

Internet and Need for Cyber Laws, Types and Causes for Cyber Crimes, Cyber Crimes Landmark Judgements in India and the Information Technology Act 2000.

Self-study / Case Study / Applications	Seminar on: • Engineers and Society. • The role of ethics in professional practice. • The importance of professional ethics in developing trust and respect in the workplace. The Importance of Ethics in Engineering.
Text Book	5

Assessment Pattern (CIE 100 Marks – Theory)

RBT Levels		**Marks Distribution**	
		Test (s)	**Alternate assessment**
		50	**50**
L1	**Remember**	**20**	**20**
L2	**Understand**	**20**	**20**
L3	**Apply**	**10**	**10**
L4	**Analyze**	**-**	**-**
L5	**Evaluate**	**-**	**-**
L6	**Create**	**-**	**-**

Suggested Learning Resources: Text Books:

1. Durga Das Basu: "Introduction to the constitution"19th/20th Edn., or 2008, Lexis Nexis; Twentieth edition (2011)
2. Shubham Singles, Charles E.Haries :Constitution of India and Professional Ethics. Latest Edition- 2018, Cengage Learning India Private Limited (2019)
3. M. Govindarajan, Natarajan, V.S. Senthilkumar," Engineering Ethics", Prentice Hall India Learning Private Limited (2013)
4. Winston, M., & Edelbach, R. (2011). Society, Ethics, and Technology. Stamford, Connecticut: Cengage Learning.
5. Cyber Security and Cyber Laws Alfred Basta and et al Cengage Learning India 2018 Reference Books

Reference Books:1.M.V. Pylee." An Introduction to Constitution of India". Vikas Publishing 2002.

UNIVERSAL HUMAN VALUES AND INDIAN ETHOS			
Course Code	**25UHV16/26**	**CIE Marks**	**100**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**-**
Hrs / Week	**1**	**Total Marks**	**100**
Credits	**NCMC**	**Exam Hours**	**-**

Course outcomes: At the end of the course, the student will be able to:

CO1	Identify their strengths, values, and life purpose while aligning self-awareness with UHV principles of happiness and harmony.
CO2	Recognize stressors and apply healthy, UHV-aligned strategies to manage stress constructively.
CO3	Build trust, empathy, and cooperation in relationships, guided by UHV principles of mutual respect and harmony.
CO4	Make ethical and value-based decisions using structured problem-solving approaches.
CO5	Resolve conflicts constructively through negotiation, mediation, and UHV-based harmony in relationships.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	3		-	-	-

MODULE-1	**SELF-AWARENESS & UHV FOUNDATIONS**	**CO1**	**3 Hours**

Introduction to Self-Awareness and UHV Principles: Concept of self-awareness (Johari Window), Self-esteem, confidence, and reflection, Discovering aspirations, values, and goals.
UHV Link and Indian Ethos: Distinction between Self and Body, need for harmony within; Insights from Arjuna's self-doubt and Krishna's guidance, Rama's equanimity, and Shivaji's life purpose.

SELF-STUDY	Reflective journal on "Who am I?"
Text Book	1

MODULE-2	**COPING WITH STRESS**	**CO2**	**3 Hours**

Understanding Stress and Healthy Coping: Causes and types of stress (academic, peer, personal), Positive vs. negative coping strategies, Techniques of relaxation, mindfulness, and time management.
UHV Link and Indian Ethos: Inner harmony through managing desires; Lessons from Abhimanyu's courage, Rani Laxmi Bai's bravery, and APJ Abdul Kalam's resilience.

Self-study	Stress diary on "What stresses me most?"
Text Book	2

MODULE-3	**INTERPERSONAL RELATIONSHIPS**	**CO3**	**3 Hours**

Building Trust and Empathy: Healthy relationships with peers, faculty, and family; Rapport, teamwork, and collaboration; Emotional support and empathy.
UHV Link and Indian Ethos: Relationships based on trust and affection; Inspired by Bharata's loyalty, Krishna–Sudama friendship, and Vikram Sarabhai's nurturing leadership.

Self-study	Reflection on "Qualities I value in a friend/peer/teacher"
Text Book	3

MODULE-4	**DECISION MAKING & PROBLEM SOLVING**	**CO4**	**3 Hours**

Structured Decision-Making: Steps – problem, alternatives, consequences, choice; Creative and critical thinking; Personal vs. professional decisions.
UHV Link and Indian Ethos: Value-based choices for holistic well-being; Yudhishthira's dharma, Shivaji's ethical strategies, and P.V. Sindhu's life decisions.

Self-study	Case analysis of ethical dilemmas (safety vs. profit).
Text Book	4

MODULE-5	**CONFLICT RESOLUTION & UHV IN DAILY LIFE**	**CO4**	**3 Hours**

Managing Conflicts Constructively: Sources of conflict (interpersonal, academic, cultural); Conflict resolution styles; Negotiation and mediation skills.
UHV Link and Indian Ethos: Resolving conflicts with respect and responsibility; Inspired by Krishna's peace mission, Hanuman's mediation, P. T. Usha's resilience, and R. K. Narayan's empathy-driven narratives.

Self-study	Roleplay/Reflection on personal conflict resolution style.
Text Book	5 & 6

CIE Assessment Pattern (100 Marks)– Skill & Value-Based Evaluation

Component	Marks	RBT Levels (Cognitive Skills)
Participation & Engagement (activities, roleplays, discussions)	20	L1,L2,L3
Reflection Journal (depth of thought, growth over sessions)	25	L2,L3,L5
Group Activity / Case Study (teamwork, ethos, application)	25	L3,L4,L5
Application Assignment (Digital Poster/Quote + 2–3 lines explanation on any UHV theme)	30	L3,L5,L6
Total	100	–

Suggested Learning Resources: TextBooks
Essence of Human Values and Professional Ethics – R.R. Gaur
Wings of Fire – A.P.J. Abdul Kalam (Autobiography)
How to Win Friends and Influence People – Dale Carnegie
Emotional Intelligence – Daniel Goleman
Ramayana & Mahabharata – C. Rajagopalachari
Malgudi Days – R.K. Narayan
Reference Books:
The Art of Happiness – Dalai Lama (for UHV principles of harmony, compassion, and stress management)
Inner Engineering – Sadhguru (aligning body, mind, and inner self)

Web links and Video Lectures (e-Resources):
https://www.coursera.org/learn/psychology-of-the-self
https://www.coursera.org/learn/emotional-intelligence-cultivating-immensely-human-interactions
https://www.skillindiadigital.gov.in/courses/detail/d7db86f0-d2d8-42aa-a8c0-502467563b5a
https://www.youtube.com/playlist?list=PLWZJ7mfdfaqw1MJ1s6JuiIcRMmhIHRU0W

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Case studies/Presentation /Journaling/ Role Play/Digital Poster making

BALAKE KANNADA			
Course Code	**25KBK17/27**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**1**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course Outcome: On completion of the course student will be able to:

CO1	Understand Kannada Language
CO2	Communicate in Kannada Language
CO3	Read simple Kannada words
CO4	Pronounce Kannada words

CO – PO Mapping:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	-	3	-	3	-	-

MODULE-1	**Introduction to Kannada Language**	CO1	**3 Hours**

1) Kannada Bhasheya Parichaya - About Kannada Language,
2) Eight Kannada Authors – JnanpiTha Awardies.
3) Karnataka State and Literature.

Self-study / Case Study / Applications	Make a chart of English, Hindi, Kannada Language
Text Book	Balake Kannada – Dr. L. Thimmesh , Prof. V. Keshavamurthy

MODULE-2	**Kannada Aksharamale haagu uchharane (Kannada Alphabets and Pronunciation)**	CO1 CO2	**3 Hours**

1) Kannada Akshara Male
2) Varnamaleya Bhagagalu
3) Ottakkasharagalu
4) Kannada kagunita

Self-study / Case Study / Applications	Any formal letter or Design advertisement board in Kannada
Text Book	Balake Kannada – Dr. L. Thimmesh, Prof. V. Keshavamurthy.

MODULE-3	**Sambhashanegaagi Kannada Padagalu (Kannada Vocabulary for Communication)**	CO3	**3 Hours**

1) Ekavachana mattu Bahuvachana
2) Manava sharirada Bhagagalu mattu Pranigala Hesaru.
3) Kala mattu Samayada haagu Dikkugalu.
4) Hannugalu Tarakarigalu hagu Tindi-thinisugala Hesarugalu

Self-study / Case Study / Applications	Write the Conversation between any two persons Example: a) Doctor and Patient b) VTU student and VTU professor
Text Book	Balake Kannada – Dr. L. Thimmesh, Prof.V. Keshavamurthy

MODULE-4	**Sambhashaneyalli Kannada (Kannada in Conversation)**	CO2 CO3	**3 Hours**

1) Naamapadagalu, Sarvanamapadagalu haagu Naamavisheshanagalu
2) Kriyapadagalu,kriyavisheshanagalu haagu Samyogagalu
3) Prashnarthaka padagalu
4) Sambhanda Suchaka Padagalu.

Self-study / Case Study / Applications	Give a pictorial representation of any topic of the Syllabus		
Text Book	Balake Kannada – Dr. L. Thimmesh , Prof. V. Keshavamurthy		
MODULE-5	Karnataka Rajyada bagge Kuritada Mahitagalu (Karnataka State and General Information about the State)	CO4	**3 Hours**

1) Karnataka Rajyada Prekshaniya Stalagalu.
2) Karnataka Rajyada 3 Bhougolika Pradeshagalu.
3) Karnatakada Kelavu Janapriya Samskruthika Kalegalu**.**

Self-study / Case Study / Applications	Write a case study on growth and development on Kannada in India.
Text Book	Balake Kannada – Dr. L. Thimmesh , Prof. V. Keshavamurthy

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s)
L1	**Remember**	10	10
L2	**Understand**	10	10
L3	**Apply**	5	5
L4	**Analyze**	-	-
L5	**Evaluate**	-	-
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**20**
L2	**Understand**	**20**
L3	**Apply**	**10**
L4	**Analyze**	**--**
L5	**Evaluate**	**--**
L6	**Create**	**--**

Suggested Learning Resources:

Text Books

1) Balake Kannada (Usage of Kannada) – Dr. L. Thimmesh
2) Vyavaharika Kannada – Prof. V Keshavamurthy

Reference Books:

1) Karnataka Samskruthi - M. Chidananda Murthy
2) Kannada Bhasha kai pidi - Sagamesha savadatti Mata
3) Mataduva Kannada – Kannada Sahitya Parishat Bangalore (2016)

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Make the groups of 4 students they should speak on any current topic in Kannada or present the talk show.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

Course Code	**25KSK17/27**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hours / Week	**1**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course Outcome: On completion of the course student will be able to:

CO1	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
CO2	ನಡುಗನ್ನಡ ಸಾಹಿತ್ಯ ಹಾಗೂ ಆಧನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡುತ್ತದೆ.
CO3	ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ ಮತ್ತು ಕಥಾ ಸಾಹಿತ್ಯದ ಮೌಲ್ಯವನ್ನು ಅರಿತುಕೊಳ್ಳುವರು.
CO4	ಕನ್ನಡದಲ್ಲಿ ತಂತ್ರಜ್ಞಾನ ವಿಷಯಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಮಾಹಿತಿಗಳನ್ನು ತಿಳಿದುಕೊಳ್ಳುವರು.

CO – PO Mapping:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	-	3	-	3	-	-

ಘಟಕ–1	**ಕನ್ನಡ ನಾಡು, ನುಡಿ ಹಾಗು ಸಂಸ್ಕೃತಿಯ ಲೇಖನಗಳು.**	CO1 CO2	**3 ಗಂಟೆಗಳು**

1) ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ– ಹಂಪ ನಾಗರಾಜಯ್ಯ.
2) ಕರ್ನಾಟಕ ಏಕೀಕರಣ– ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ– ಜಿ ವೆಂಕಟಸುಬ್ಬಯ್ಯ.
3) ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ– ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ್ ,ಪ್ರೊ.ವಿ.ಕೇಶವಮೂರ್ತಿ.

Self-study / Case Study / Applications	ಕನ್ನಡ ನಾಡು ನುಡಿ,ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಪ್ರಬಂಧ ರಚನೆ. ಕರ್ನಾಟಕ ಏಕೀಕರಣದಲ್ಲಿ ಭಾಗವಹಿಸಿದ ವ್ಯಕ್ತಿಗಳ ಚಿತ್ರದೊಂದಿಗೆ ಮಾಹಿತಿ ಸಂಗ್ರಹ.
ಪಠ್ಯಪುಸ್ತಕ	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ – ಡಾ. ಹಿ.ಚಿ ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ್.

ಘಟಕ –2	**ನಡುಗನ್ನಡ ಸಾಹಿತ್ಯ**	CO1 CO2	**3 ಗಂಟೆಗಳು**

1) ಆಯ್ದ ವಚನಗಳು– ಜೇಡರದಾಸಿಮಯ್ಯ. ಅಲ್ಲಮಪ್ರಭು, ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಆಯ್ದಕ್ಕಿಮಾರಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ.
2) ಆಯ್ದ ಕೀರ್ತನೆಗಳು– ಪುರಂದರದಾಸರು, ಕನಕದಾಸರು.
3) ತತ್ವಪದ – ಶಿಶುನಾಳ ಷರೀಫರು.

Self-study / Case Study / Applications	ಪ್ರಸಿದ್ಧ ವಚನಕಾರರ ವಚನಗಳ ಸಂಗ್ರಹ. ವಚನಗಳ ಸಮೂಹ ಗಾಯನ, ಕೀರ್ತನೆ ಹಾಗು ತತ್ವಪದಗಳ ಸಂಗ್ರಹ.
ಪಠ್ಯಪುಸ್ತಕ	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ – ಡಾ. ಹಿ.ಚಿ ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ್.

ಘಟಕ –3	**ಆಧುನಿಕ ಸಾಹಿತ್ಯ.**	CO2 CO3	**3 ಗಂಟೆಗಳು**
1) ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದ ಕೆಲವು ಆಯ್ದ ಪದ್ಯಗಳು– ಡಿ.ವಿ.ಜಿ. 2) ಕುರುಡು ಕಾಂಚಾಣ– ದ.ರಾ.ಬೇಂದ್ರೆ. 3) ಹೊಸಬಾಳಿನ ಗೀತೆ– ಕುವೆಂಪು.			
Self-study / Case Study / Applications	ಪ್ರಸಿದ್ಧ ಕನ್ನಡ ಕವಿಗಳ ಭಾವಚಿತ್ರದೊಂದಿಗೆ ಮಾಹಿತಿ ಸಂಗ್ರಹ.		
ಪಠ್ಯಪುಸ್ತಕ	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ – ಡಾ. ಹಿ.ಚಿ ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ್.		
ಘಟಕ –4	**ವ್ಯಕ್ತಿ ಪರಿಚಯ ಮತ್ತು ಕಥೆ.**	CO2 CO3	**3 ಗಂಟೆಗಳು**
1) ಸರ್. ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ. 2) ಸುಧಾಮೂರ್ತಿ. 3) ಯುಗಾದಿ– ವಸುಧೇಂದ್ರ.			
Self-study / Case Study / Applications	ಸರ್. ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ ಅವರು ಕರ್ನಾಟಕದಲ್ಲಿ ಕೈಗೊಂಡ ಅಭಿವೃದ್ಧಿ ಕಾರ್ಯಗಳ ಬಗ್ಗೆ ಮಾಹಿತಿ ಸಂಗ್ರಹ. ಸುಧಾಮೂರ್ತಿ ಅವರ ಜೀವನ ಮತ್ತು ಸಾಧನೆಯ ಬಗ್ಗೆ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.		
ಪಠ್ಯಪುಸ್ತಕ	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ – ಡಾ. ಹಿ.ಚಿ ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ್.		
ಘಟಕ –5	**ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ.**	CO3 CO4	**3 ಗಂಟೆಗಳು**
1) ಕ ಮತ್ತು ಬ ಬರಹ ತಂತ್ರಾಂಶಗಳು. 2) ತಾಂತ್ರಿಕ ಪದಕೋಶ ಮತ್ತು ಕನ್ನಡ ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಕೋಶ. 3) ಕನ್ನಡದಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆ ಬಳಕೆ.			
Self-study / Case Study / Applications	ಕನ್ನಡ ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಗಳನ್ನು ಪಟ್ಟಿಮಾಡುವುದು. ಕನ್ನಡದಲ್ಲಿ ಕೃತಕ ಬುದ್ಧಿಮತ್ತೆಯ ಬಳಕೆ ಕುರಿತು ಚರ್ಚಿಸುವುದು.		
ಪಠ್ಯಪುಸ್ತಕ	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ – ಡಾ. ಹಿ.ಚಿ ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ್.		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s)
L1	**Remember**	10	10
L2	**Understand**	10	10
L3	**Apply**	5	5
L4	**Analyze**	-	-
L5	**Evaluate**	-	-
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**20**
L2	**Understand**	**20**
L3	**Apply**	**10**
L4	**Analyze**	**--**
L5	**Evaluate**	**--**
L6	**Create**	**--**

ಸೂಚಿಸಲಾದ ಕಲಿಕಾ ಸಂಪನ್ಮೂಲಗಳು:

ಪಠ್ಯ ಪುಸ್ತಕ

1) ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ – ಡಾ. ಹಿ.ಚಿ ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ್.

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು:

1) ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಎಂ.ಚಿದಾನಂದಮೂರ್ತಿ.

2) ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ- ಡಾ. ಎಚ್.ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ.

3) ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ– ರಂ ಶ್ರೀ ಮುಗಳಿ.

Interdisciplinary Project based learning

Course Code	25IPL18/28	**CIE Marks**	50
L:T:P:S	0:0:0:1	**SEE Marks**	50
Hrs / Week	2	**Total Marks**	100
Credits	1	**Exam Hours**	3

Course Outcomes - On completion of the course, students will be able to

CO1	Identify and define problems requiring interdisciplinary knowledge
CO2	Apply basic concepts of science, engineering, and technology to design simple solutions.
CO3	Work effectively in teams with defined roles and responsibilities.
CO4	Use project management, documentation, and presentation skills.
CO5	Develop socially relevant, sustainable, and innovative prototypes/solutions

Mapping of Course Outcomes to Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	1	-	-	2	-	-
CO2	2	2	2	1	1	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	1	3	2	1
CO4	-	-	1	-	-	-	-	-	2	3	2
CO5	1	2	2	1	1	2	2	-	-	2	1

Week - 1, 2 & 3: Introduction, Orientation, Team Formation and Literature Survey

Week -1&2: Introduction to project-based learning & interdisciplinarity. Motivational talk / case studies of successful student projects. Ice-breaking and team-building activities. Formation of groups (4–6 students). Selection of broad theme areas. Brainstorming techniques {mind mapping, 5W1H (what, who, when, where, why, and how). Identifying problems. Discuss feasibility & Interdisciplinarity. Mentor approval of project problem.

Week-3: How to search for prior work (journals, patents, research project, case studies). Understanding user needs. Role of each engineering branch in solving the problem.

Deliverables - Team list + chosen theme area and Literature survey report.

Week- 4, 5 and 6: Problem Statement, Multiple Solution Ideas and Selection of Best IDEA

Week-4&5: Refining the problem statement. Identifying constraints and scope. Framing objectives & expected outcomes. Generating multiple solution ideas. Discussing feasibility (technical, economic, social). Team roles assigned (design, research, coding, documentation, testing).

Week-6: Criteria-based selection of best idea (decision matrix). Rough sketches, block diagrams, flowcharts. Resource planning (materials, software, tools).

Deliverables - Finalized Problem definition with objectives, List of solution concepts (sketches/flowcharts) and Design document (diagrams, flow)

Week -7, 8 and 9: Selection of Best IDEA and Prototyping

Week-7: Work breakdown structure (task division). Timeline for development. Safety & ethical considerations.

Week-8&9: Development of subsystems/modules, Application of classroom knowledge (electrical circuits, coding, mechanics, CAD, etc.), Peer & mentor review sessions.

Week 9, 10,11&12: Prototyping stage 2 using Atal Idea Lab/Makers Space
Week-9&10: Integration of subsystems. Debugging & troubleshooting. Improvement based on test results. **Week-11&12:** Testing against objectives & user requirements. Experimentation results (tables, graphs). Analysing failures/limitations.
Deliverables – Prototype/working model, Testing Results, Limitations/challenges
Week 13 & 14: Refinement & Pre-Final Review
Week-13&14: Refining prototype for efficiency, cost, sustainability. Internal review & peer feedback. Preparing visuals for final presentation (posters, PPT, demo video).
Deliverables – Final Results of Experimentation or Testing & Working/ Prototype Model
Week 15 & 16: Final Demo and Social Pitch
Project pitching to jury - Presentation of the project with impact with assessment, prototype, and sustainability plan

Teaching-Learning Process (Innovative Delivery Methods)

Activity Based Learning

Group discussion, Presentations.

One faculty member shall be assigned to group of 60 students or one division.

Each group shall contain Min. 4 and Max. 6 students.

Nature of the group shall be multidisciplinary. (Group shall be formed by selecting students from all branches)

Continuous Internal Evaluation (CIE) – 50 Marks

CIE Parameters (50 Marks)

Stage/Activity	Marks (out of 50)	Description
Weeks 1–4: Problem Identification & Literature Survey	05 marks	Focus on forming teams, identifying problems, understanding user needs, and reviewing prior work through journals, patents, etc.
Weeks 5–7: Concept Development & Design	10 marks	Defining problem statements, framing objectives, generating ideas, preparing diagrams, flowcharts, and resource planning.
Weeks 8–11: Prototype Development	15 marks	Creating subsystems, applying theoretical knowledge, peer and mentor review sessions, debugging, and troubleshooting.
Week 12: Testing & Validation	5 marks	Evaluating the prototype's performance, user requirements, experiments, and analysis of failures.
Weeks 13–14: Documentation & Presentation	15 marks	Finalizing the prototype, improving based on feedback, preparing presentations, reports, and demonstration materials.

Semester End Examination (SEE) – 50 Marks

SEE to be conducted in batches where the students will exhibit their projects along with the presentation and Viva -voce. – 50 Marks

Criteria	Marks (out of 50)	Description
Final Presentation & Demonstration	10	Clear articulation of the problem, solution approach, prototype, and team contribution. Delivery, engagement, and response to questions are evaluated.
Prototype Quality & Functionality	10	Working model evaluation, application of engineering principles, problem-solving effectiveness, debugging, and system integration.
Documentation Report	10	Completeness, structure, accuracy, clarity in diagrams, data analysis, testing results, and conclusions.
Social Impact & Sustainability	10	Relevance to society, cost-effectiveness, ethical considerations, environmental impact, and scalability.
Innovation & Originality	5	Creativity, uniqueness, feasibility, and application of interdisciplinary concepts.
Viva – voce	05	Viva – voce

Submission Requirements:

Handwritten activity book with CIE marks and Final project report (Typed or Handwritten).

Final presentation ppt/pdf (hard and soft copy).

Prototype or working model [physical or conceptual (shall be drawn/sketched clearly on card sheet paper)].

Peer/team feedback and reflection entries (if applicable).

ENVIRONMENT AND DISASTER MANAGEMENT			
Course Code	25EDM18/28	**CIE**	50
L:T:P:S	1:0:0:0	**SEE Marks**	50
Hrs / Week	1	**Total Marks**	100
Credits	01	**Exam Hours**	02

Course outcomes: At the end of the course, the student will be able to:

CO1	Analyze the structure and function of various ecosystems and the importance of biodiversity.
CO2	Evaluate advances in energy systems and disaster management.
CO3	Assess the sources, impacts, and preventive measures of environmental pollution, and effective waste management practices.
CO4	Investigate global environmental issues and groundwater problems, along with their associated policies and case studies.
CO5	Interpret key environmental legislation in India.

Mapping of Course Outcomes to Program Outcome.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	2	-	-	-	-
CO2	-	-	-	2	-	1	-	-	-	-	-
CO3	3		2	-	-	-	2	-	-	-	-
CO4	3	2	-	-	-	-	2	1	-	-	-
CO5	3	2	-	-	-	-	2	1	-	-	-

MODULE-1	Ecosystem and Biodiversity	CO1	3 Hours

Ecosystem

Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake.

Biodiversity

Biodiversity-Introduction, types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-Wild life conflicts – endangered and endemic species of India – conservation of biodiversity.

Self-study	Conservation of biodiversity
Text Book	Text Book :1

MODULE-2	Advances in Energy Systems and Disaster Management	CO2	3 Hours

Advances in Energy Systems

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.

Disaster Management

Disaster Management, Earthquake, volcanoes, causes of volcanism, floods ,landslides, drought, Glacial Lake Outburst Floods (GLOF);sea level changes and its impact on coastal areas and coastal zone

Assignment	Various energy systems, merits, demerits, applications
Text Book	Text Book :2

MODULE-3	Environmental pollution and Waste Management	CO3	3 Hours

Environmental pollution

Environmental Pollution –Water, soil, air (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental (Case-studies)

Waste Management

Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; Industrial and Municipal Sludge.

Case Study	Environmental pollution
Text Book	Text Book :1

MODULE-4	Global Environmental Concerns	CO4	3 Hours

Global Environmental Concerns
Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Presentation	Effect of pollution on climate change		
Text Book	Text book:2		
MODULE-5	Environmental acts	CO5	3 Hours

Environmental acts
The Indian Forest Act 1927; The Wildlife (Protection) Act 1972; The Water (Prevention and Control of Pollution) Act 1974; The Forests (Conservation) Act 1980; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; Noise Pollution (Regulation and Control) Rules 2000; Eco marks.

Case Study	Environmental acts
Text Book	Reference books:1,2,3

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	5	5
L2	Understand	10	10
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	-	
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Text Books

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018

Reference Books: -

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental studies, university of science press 1st edition

Web links and Video Lectures (e-Resources):

1. https://sdgs.un.org/goals
2. https://archive.nptel.ac.in/courses/109/105/109105190/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Visit to a local area to document environmental assets-river/ forest/ grassland/ hill/ mountain
2. Visit to a local polluted site – urban / rural / industrial / agricultural
3. Study of common plants, insects, and birds
4. Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

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