



GOVERNMENT COLLEGE OF ENGINEERING, SALEM

(NAAC Accredited with A⁺, An Autonomous Institution, Affiliated to Anna University, Chennai)

UNDERGRADUATE CURRICULUM

(Applicable to the students admitted in B.E. Programme, from the Academic Year 2026-2027)

Programme: B.E. Electronics and Communication Engineering (Full Time)

Regulations: 2026

Overview of Credits

Sem	BS	HM	ES(G)	ES(PC)	ES(PE)	OE	SD	MC	Total
I	12	3	4				2		21
II	7	3	8	4					22
III	3			20				3	26
IV	3			19			1	3	26
V		2		15	3		1		21
VI				8	9	3	3		23
VII				14	6				20
VIII							10		10
Total	25	8	12	80	18	3	17	6	169
% of Category	14.79	4.73	7.10	47.34	10.65	1.78	10.06	3.55	100

Abbreviations:

Course Type:

T - Theory
L - Laboratory
LIT - Laboratory Integrated Theory
CDP - Capstone Design Project
PW - Project Work
IOC – Industry Oriented Course

Category :

BS - Basic Science
HM - Humanities
ES - Engineering Science [General (**G**)
 Programme Core (**PC**)
 Programme Elective (**PE**)]
OE - Open Elective
SD - Skill Development
MC - Mandatory Course

Others :

L - Lecture
T - Tutorial
P - Practical
SL - Term work (TW) + Self Learning (SL)
TH - Total Number of Teaching – Learning Hours per Semester

Semester I													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26MAC01	Matrices and Calculus	T	45	15	0	60	120	4	BS	40	60	100
2.	26ENC01	Communicative English	T	45	0	0	15	60	2	HM	40	60	100
3.	26PHC01	Applied Physics	LIT	45	0	45	30	120	4	BS	50	50	100
4.	26CYC01	Applied Chemistry	LIT	45	0	45	30	120	4	BS	50	50	100
5.	26CSC01	C Programming	LIT	45	0	30	45	120	4	ES(G)	50	50	100
6.	26HMC01	Heritage of Tamils / தமிழர் மரபு	T	15	0	0	15	30	1	HM	40	60	100
7.	26MEC02	Engineering Practices Laboratory	L	0	0	45	15	60	2	SD	60	40	100
8.	26MCC01	Induction Program	T	-	-	-	-	-	0	MC	-	-	-
Total								630	21				

Semester II													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26MAC02	Ordinary Differential Equations and Transform Techniques	T	45	15	0	60	120	4	BS	40	60	100
2.	26ENC02	Professional English	LIT	30	0	15	15	60	2	HM	50	50	100
3.	26PHC02	Materials Science	T	45	0	0	45	90	3	BS	40	60	100
4.	26EC201	Electronic Devices	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
5.	26HMC02	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	T	15	0	0	15	30	1	HM	40	60	100
6.	26EEC01	Basic Electrical and Electronics Engineering	LIT	45	0	45	30	120	4	ES(G)	50	50	100
7.	26MEC01	Engineering Graphics	T	30	45	0	45	120	4	ES(G)	40	60	100
8.	26MCS01	Engineering Sprints	L	0	0	15	15	30	0	SD	100	-	100
9.	26NCC01	NCC Course - I*	T	30	0	0	30	60	2*	-	40	60	100
Total								750	22				

*< Only for NCC Students, it is not considered for CGPA Calculation >

Semester III													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26MAC04	Partial Differential Equations and Complex Variables	T	45	15	0	30	90	3	BS	40	60	100
2.	26EC301	Analog Circuits - I	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26EC302	Digital System Design	LIT	45	15	45	15	120	4	ES(PC)	50	50	100
4.	26EC303	Network Theory and Synthesis	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26EC304	Signals and Systems	T	45	15	0	60	120	4	ES(PC)	40	60	100
6.	26EC305	Problem Solving using Python	LIT	45	15	45	15	120	4	ES(PC)	50	50	100
7.	26EC306	Analog Circuits - I Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
8.	26MCC03	Universal Human Values	T	45	0	0	45	90	3	MC	40	60	100
9.	26MCS02	Innovation Sprints	L	0	0	15	15	30	0	SD	100	-	100
10.	26NCC02	NCC Course – II*	T	30	0	0	30	60	2*	-	40	60	100
Total								870	26				

*< Only for NCC Students, it is not considered for CGPA Calculation >

Semester IV													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26MAC05	Statistics and Random Processes	T	45	15	0	30	90	3	BS	40	60	100
2.	26EC401	Analog Circuits - II	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26EC402	Microprocessors and Microcontrollers	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26EC403	Analog Communication	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26EC404	Control Systems	T	45	0	0	45	90	3	ES(PC)	40	60	100
6.	26EC405	Transmission Lines and Waveguides	T	45	0	0	45	90	3	ES(PC)	40	60	100
7.	26EC406	Analog Circuits - II Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
8.	26EC407	Microprocessors and Microcontrollers Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
9.	26MCC02	Environmental Science and Engineering	T	45	0	0	45	90	3	MC	40	60	100
10.	26ECICXX	Industry Oriented Course - I	IOC	15	0	0	15	30	1	SD	100	-	100
11.	26MCC04	Disaster Management and Preparedness	T	30	0	0	30	60	0	MC	100	-	100
12.	26MCS03	Design Sprints	L	0	0	15	15	30	0	SD	100	-	100
Total								870	26				

Semester V													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26EC501	Digital Communication	T	45	0	0	45	90	3	ES(PC)	40	60	100
2.	26EC502	Digital Signal Processing	LIT	45	15	45	15	120	4	ES(PC)	50	50	100
3.	26EC503	Antennas and Wave Propagation	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26EC504	Data Communication Networks	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26EC505	Communication Systems Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
6.	26ECPEXX	Programme Elective-I	T	45	0	0	45	90	3	ES(PE)	40	60	100
7.	26ENC03	Placement and Soft Skills Laboratory	L	0	0	45	15	60	2	HM	60	40	100
8.	26ECICXX	Industry Oriented Course - II	IOC	15	0	0	15	30	1	SD	100	-	100
9.	26MCC05	Indian Constitution	T	30	0	0	30	60	0	MC	100	-	100
10.	26MCS04	Ideation Sprints	L	0	0	15	15	30	0	SD	100	-	100
Total								720	21				

Semester V													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
For Honours Degree													
1.	26ECD01	Capstone Design Project Level-I	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26ECHXX	Honours Elective - I	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26ECHXX	Honours Elective - II	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26ECMXX	Minor Elective - I	T	45	0	0	45	90	3	OE	40	60	100
2.	26ECMXX	Minor Elective - II	T	45	0	0	45	90	3	OE	40	60	100
Total								180	6				

Semester VI													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26EC601	VLSI Design	T	45	0	0	45	90	3	ES(PC)	40	60	100
2.	26EC602	Embedded Systems	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26ECPEXX	Programme Elective - II	T	45	0	0	45	90	3	ES(PE)	40	60	100
4.	26ECPEXX	Programme Elective - III	T	45	0	0	45	90	3	ES(PE)	40	60	100
5.	26ECPEXX	Programme Elective - IV	T	45	0	0	45	90	3	ES(PE)	40	60	100
6.	26XXOEXX	Open Elective - I	T	45	0	0	45	90	3	OE	40	60	100
7.	26EC603	VLSI Design and Embedded Systems Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
8.	26EC604	Mini Project	PW	0	0	45	45	90	3	SD	100	-	100
Total								690	23				

Semester VI													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
For Honours Degree													
1.	26ECD02	Capstone Design Project Level-II	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26ECHXX	Honours Elective - III	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26ECHXX	Honours Elective - IV	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26ECMXX	Minor Elective - III	T	45	0	0	45	90	3	OE	40	60	100
2.	26ECMXX	Minor Elective - IV	T	45	0	0	45	90	3	OE	40	60	100
Total								180	6				

Semester VII													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26EC701	Wireless and Mobile Communication	T	45	0	0	45	90	3	ES(PC)	40	60	100
2.	26EC702	Optical Communication	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26EC703	Microwave Engineering	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26EC704	Digital Image Processing	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26ECPEXX	Programme Elective - V	T	45	0	0	45	90	3	ES(PE)	40	60	100
6.	26ECPEXX	Programme Elective - VI	T	45	0	0	45	90	3	ES(PE)	40	60	100
7.	26EC705	Optical and Microwave Engineering Laboratory	L	0	0	45	15	60	2	ES (PC)	60	40	100
Total								600	20				

Semester VII													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
For Honours Degree													
1.	26ECD03	Capstone Design Project Level-III	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26ECHXX	Honours Elective - V	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26ECHXX	Honours Elective - VI	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26ECMXX	Minor Elective - V	T	45	0	0	45	90	3	OE	40	60	100
2.	26ECMXX	Minor Elective - VI	T	45	0	0	45	90	3	OE	40	60	100
Total								180	6				

Semester VIII													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26EC801	Project Work	PW	0	0	225	75	300	10	SD	60	40	100
Total								300	10				
Total Credits of the Programmes									169				

Programme Electives

Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
Programme Elective - I (V Semester)													
1.	26ECPE01	Electronic Measurements	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26ECPE02	Virtual Instrumentation	T	45	0	0	45	90	3	ES(PE)	40	60	100
3.	26ECPE03	RF and EMI/EMC Testing	T	45	0	0	45	90	3	ES(PE)	40	60	100
4.	26ECPE04	Bio Medical Electronics	T	45	0	0	45	90	3	ES(PE)	40	60	100
5.	26ECPE05	Modern Sensors and its Applications	T	45	0	0	45	90	3	ES(PE)	40	60	100
Programme Elective - II (VI Semester)													
6.	26ECPE06	Multimedia Compression and Communication Techniques	T	45	0	0	45	90	3	ES(PE)	40	60	100
7.	26ECPE07	Radar Communication	T	45	0	0	45	90	3	ES(PE)	40	60	100
8.	26ECPE08	Satellite Communication	T	45	0	0	45	90	3	ES(PE)	40	60	100
9.	26ECPE09	Software Defined Radio	T	45	0	0	45	90	3	ES(PE)	40	60	100
10.	26ECPE10	Cognitive Radio Networks	T	45	0	0	45	90	3	ES(PE)	40	60	100
11.	26PSC01	Applied Design Thinking	T	45	0	0	45	90	3	ES(PE)	100	0	100

Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
Programme Elective - III (VI Semester)													
12.	26ECPE11	Network Security	T	45	0	0	45	90	3	ES(PE)	40	60	100
13.	26ECPE12	High Speed Networks	T	45	0	0	45	90	3	ES(PE)	40	60	100
14.	26ECPE13	Massive MIMO Networks	T	45	0	0	45	90	3	ES(PE)	40	60	100
15.	26ECPE14	Wireless Sensor Networks	T	45	0	0	45	90	3	ES(PE)	40	60	100
16.	26ECPE15	Telecommunication and Switching Networks	T	45	0	0	45	90	3	ES(PE)	40	60	100
17.	26PSC02	Startup Fundamentals	T	45	0	0	45	90	3	ES(PE)	100	0	100
Programme Elective - IV (VI Semester)													
18.	26ECPE16	Internet of Things	T	45	0	0	45	90	3	ES(PE)	40	60	100
19.	26ECPE17	Embedded C	T	45	0	0	45	90	3	ES(PE)	40	60	100
20.	26ECPE18	Automotive Electronics	T	45	0	0	45	90	3	ES(PE)	40	60	100
21.	26ECPE19	Robotics	T	45	0	0	45	90	3	ES(PE)	40	60	100
22.	26ECPE20	Computer Organization and Architecture	T	45	0	0	45	90	3	ES(PE)	40	60	100
Programme Elective - V (VII Semester)													
23.	26ECPE21	Artificial Intelligence	T	45	0	0	45	90	3	ES(PE)	40	60	100
24.	26ECPE22	Machine Learning	T	45	0	0	45	90	3	ES(PE)	40	60	100
25.	26ECPE23	Deep Learning	T	45	0	0	45	90	3	ES(PE)	40	60	100
26.	26ECPE24	Natural Language Processing	T	45	0	0	45	90	3	ES(PE)	40	60	100
27.	26ECPE25	Data Science	T	45	0	0	45	90	3	ES(PE)	40	60	100
Programme Elective - VI (VII Semester)													
28.	26ECPE26	VLSI Physical Design	T	45	0	0	45	90	3	ES(PE)	40	60	100
29.	26ECPE27	System on Chip Design	T	45	0	0	45	90	3	ES(PE)	40	60	100
30.	26ECPE28	Micro Electro Mechanical Systems	T	45	0	0	45	90	3	ES(PE)	40	60	100
31.	26ECPE29	Nano Electronics	T	45	0	0	45	90	3	ES(PE)	40	60	100
32.	26ECPE30	Integrated Circuit Design	T	45	0	0	45	90	3	ES(PE)	40	60	100

Open Electives

Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
Courses Offered by the Department of Civil Engineering													
1.	26CEOE01	Environmental Management	T	45	0	0	45	90	3	OE	40	60	100
2.	26CEOE02	Repair and Rehabilitation of Building Elements	T	45	0	0	45	90	3	OE	40	60	100
3.	26CEOE03	Mechanics of Deformable Bodies	T	45	0	0	45	90	3	OE	40	60	100
Courses Offered by the Department of Computer Science and Engineering													
1.	26CSOE01	Object Oriented Programming Concepts	T	45	0	0	45	90	3	OE	40	60	100
2.	26CSOE02	Operating Systems Principles	T	45	0	0	45	90	3	OE	40	60	100
3.	26CSOE03	Python Programming	T	45	0	0	45	90	3	OE	40	60	100
4.	26CSOE04	Fundamentals of Java Programming	T	45	0	0	45	90	3	OE	40	60	100
5.	26CSOE05	Data Structures using C	T	45	0	0	45	90	3	OE	40	60	100
6.	26CSOE06	Introduction to Artificial Intelligence	T	45	0	0	45	90	3	OE	40	60	100
7.	26CSOE07	Cloud Computing Fundamentals	T	45	0	0	45	90	3	OE	40	60	100
Courses Offered by the Department of Electronics and Communication Engineering													
1.	26ECOE01	Fundamentals of Electron Devices	T	45	0	0	45	90	3	OE	40	60	100
2.	26ECOE02	Principles of Modern Communication Systems	T	45	0	0	45	90	3	OE	40	60	100
3.	26ECOE03	Microcontrollers and Its Applications	T	45	0	0	45	90	3	OE	40	60	100
4.	26ECOE04	Basics of Embedded Systems	T	45	0	0	45	90	3	OE	40	60	100
5.	26ECOE05	Basics of Internet of Things	T	45	0	0	45	90	3	OE	40	60	100

Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
Courses Offered by the Department of Electrical and Electronics Engineering													
1.	26EEOE01	Renewable Energy Systems	T	45	0	0	45	90	3	OE	40	60	100
2.	26EEOE02	Industrial Drives	T	45	0	0	45	90	3	OE	40	60	100
3.	26EEOE03	Electrical Energy Conservation and Management	T	45	0	0	45	90	3	OE	40	60	100
4.	26EEOE04	Fundamentals of Electric Vehicle	T	45	0	0	45	90	3	OE	40	60	100
5.	26EEOE05	Electrical Safety and Energy Auditing	T	45	0	0	45	90	3	OE	40	60	100
6.	26EEOE06	Energy Storage Systems and its Applications	T	45	0	0	45	90	3	OE	40	60	100
Courses Offered by the Department of Mechanical Engineering													
1.	26MEOE01	Design of Machine Elements and Machining	T	45	0	0	45	90	3	OE	40	60	100
2.	26MEOE02	Internal Combustion Engines	T	45	0	0	45	90	3	OE	40	60	100
3.	26MEOE03	Refrigeration and Air conditioning	T	45	0	0	45	90	3	OE	40	60	100
4.	26MEOE04	Power Plant Engineering	T	45	0	0	45	90	3	OE	40	60	100
5.	26MEOE05	Hydraulics and Pneumatics	T	45	0	0	45	90	3	OE	40	60	100
6.	26MEOE06	Industrial Engineering and Management	T	45	0	0	45	90	3	OE	40	60	100
7.	26MEOE07	Renewable Energy Sources	T	45	0	0	45	90	3	OE	40	60	100
8.	26MEOE08	Robotics and Automation	T	45	0	0	45	90	3	OE	40	60	100
9.	26MEOE09	Total Quality Management	T	45	0	0	45	90	3	OE	40	60	100
10.	26MEOE10	Automotive Systems	T	45	0	0	45	90	3	OE	40	60	100
Courses Offered by the Department of Metallurgical Engineering													
1.	26MTOE01	Foundry and Welding Technology	T	45	0	0	45	90	3	OE	40	60	100
2.	26MTOE02	Surface Engineering	T	45	0	0	45	90	3	OE	40	60	100
3.	26MTOE03	Design and Selection of Materials	T	45	0	0	45	90	3	OE	40	60	100
4.	26MTOE04	Nano Science and Technology	T	45	0	0	45	90	3	OE	40	60	100
5.	26MTOE05	Materials for Automobile Components	T	45	0	0	45	90	3	OE	40	60	100
6.	26MTOE06	Metallurgy for Non-metallurgist	T	45	0	0	45	90	3	OE	40	60	100

List of Honours Courses

Sl. No.	Course Code	Course Name
1.	26ECH01	Next Generation Networks
2.	26ECH02	5G Communication Networks
3.	26ECH03	Software Defined Networks
4.	26ECH04	Embedded System for Networking
5.	26ECH05	Statistical Theory of Communication
6.	26ECH06	Millimeter Wave Communication
7.	26ECH07	Smart Antennas
8.	26ECH08	RF IC and Microwave MEMs
9.	26ECH09	Brain Computer Interface and Applications
10.	26ECH10	Speech Processing
11.	26ECH11	Wavelet Signal Processing
12.	26ECH12	Biomedical Signal and Image Processing
13.	26ECH13	Analog CMOS IC Design
14.	26ECH14	DSP Integrated Circuits
15.	26ECH15	Mixed Signal VLSI Design

List of Minors Courses

Sl. No.	Course Code	Course Name
1.	26ECM01	Electron Devices and Circuits
2.	26ECM02	Digital Electronics
3.	26ECM03	Signal Processing
4.	26ECM04	Fundamentals of Microprocessors and Microcontrollers
5.	26ECM05	Analog and Digital Communication
6.	26ECM06	Communication Networks
7.	26ECM07	Fundamentals of IoT
8.	26ECM08	Wireless Sensors and Networking
9.	26ECM09	Fundamentals of Embedded Systems
10.	26ECM10	Basics of VLSI Design

26MAC01	MATRICES AND CALCULUS B.E. (Common to all Branches Except EEE)		SEMESTER			I	
Prerequisites		Category	BS	Credits		4	
1. Basic 12th level Matrices, Differential Calculus and Integral Calculus.		Hours/ Semester	L	T	P	SL	TH
			45	15	0	60	120
COURSE OBJECTIVES							
1.	To understand the fundamental concepts of matrices, eigen values, eigen vectors, diagonalization and quadratic forms for solving algebraic and engineering problems.						
2.	To develop knowledge in functions of several variables, partial differentiation, Jacobians, and optimization techniques involving maxima, minima and Lagrange multipliers.						
3.	To apply techniques of integral calculus, including differentiation under the integral sign, Leibnitz rule, and Beta and Gamma functions in the evaluation of integrals.						
4.	To acquire problem-solving skills in double and triple integrals, change of variables and applications related to area and volume computations.						
5.	To understand and apply vector calculus concepts such as gradient, divergence, curl, line, surface, and volume integrals along with Green's, Stoke's and Gauss divergence theorems in mathematical and engineering applications.						
UNIT - I	MATRICES						9+3
Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors– Cayley–Hamilton theorem (excluding proof) – Diagonalization of matrices – Reduction of Quadratic form to canonical form by using orthogonal transformation – Nature of a Quadratic form.							
UNIT - II	FUNCTIONS OF SEVERAL VARIABLES						9+3
Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Jacobians – Taylor's formula for two variables– Maxima and Minima of functions of two variables – Lagrange's method of undermined multipliers.							
UNIT - III	INTEGRAL CALCULUS						9+3
Differentiation under integrals – Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions– Properties – Evaluation of single integrals by using Beta and Gamma functions.							
UNIT - IV	MULTIPLE INTEGRALS						9+3
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals.							
UNIT - V	VECTOR CALCULUS						9+3
Gradient of a scalar field, directional derivative – Divergence and Curl – Solenoidal and Irrotational vector fields – Line integrals over a plane curve – Surface integrals – Area of a curved surface – Volume Integral – Green's theorem, Stoke's and Gauss divergence theorems (without proofs)– Verification and applications in evaluating line, surface and volume integrals.							
L:45, T:15, SL:60, Total:120 Hours							

Weightage: Continuous Assessment: 40% End Semester Examinations: 60%				
TEXT BOOKS:				
1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45 th Edition, New Delhi, 2020.			
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", 10 th Edition, Wiley India Pvt Ltd., New Delhi, 2018.			
REFERENCE BOOKS:				
1.	James Stewart, Daniel K Clegg & Saleem Watson, "Calculus with Early Transcendental Functions", Cengage Learning, 6 th Edition, New Delhi, 2023.			
2.	Joel Hass, Christopher Heil, Maurice D.Weir, "Thomas' Calculus", 14 th Edition, Pearson Education, New Delhi, 2018.			
3.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5 th Edition, New Delhi, 2017.			
E-RESOURCES:				
1.	NPTEL, "Engineering Mathematics-I", National Programme on Technology Enhanced Learning, https://www.nptel.ac.in/courses/111105121			
2.	MIT OpenCourseWare, "Single Variable Calculus and Multivariable Calculus", Massachusetts Institute of Technology, https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/			
3.	Khan Academy, "Linear Algebra and Multivariable Calculus", https://www.khanacademy.org/math/linear-algebra , https://www.khanacademy.org/math/multivariable-calculus			
4.	Paul's Online Math Notes, "Calculus III and Linear Algebra", Lamar University, https://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx			
5.	Wolfram MathWorld, "Mathematics Resource", Wolfram Research, https://mathworld.wolfram.com/topics/VectorCalculus.html			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Remember and understand the fundamental concepts and methods in matrices, functions of several variables, integral calculus, multiple integrals and vector calculus including eigen values and eigen vectors, Cayley–Hamilton theorem, quadratic forms, partial derivatives, Jacobians, maxima and minima, Beta and Gamma functions, double and triple integrals, gradient, divergence, curl and Green's, Stoke's and Gauss divergence theorems.		--	--
CO2	Apply the concepts and techniques of matrices, functions of several variables, integral calculus, multiple integrals and vector calculus to solve mathematical and engineering problems involving eigen values and quadratic forms, optimization of multivariable functions, evaluation of integrals using Beta and Gamma functions, computation of areas and volumes through multiple integrals and evaluation of line, surface, and volume integrals using Green's, Stoke's and Gauss divergence theorems.		PO1	PSO1

C03	Analyze mathematical and engineering problems using the principles of matrices, functions of several variables, integral calculus, multiple integrals and vector calculus by interpreting eigen values and quadratic forms, examining extrema of multivariable functions, selecting suitable integration techniques, transforming multiple integrals using coordinate changes and analyzing vector fields through divergence, curl and integral theorems.	PO2	PS01
C04	Design and develop mathematical solution strategies using matrices, multivariable calculus, multiple integrals, and vector calculus techniques for solving engineering problems related to optimization, coordinate transformations, area and volume computations and vector field analysis.	PO3	PS02
C05	Communicate and interpret mathematical results effectively by applying appropriate mathematical representations, analytical methods and vector integral theorems in solving practical and engineering-oriented problems.	PO10	PS02
C06	Utilize mathematical and computational techniques from matrices, multivariable calculus, integral calculus, multiple integrals, and vector calculus to model, interpret and solve real-world engineering and scientific problems effectively.	PO5	PS02

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01														
C02	3											3		
C03		2										2		
C04			1										2	
C05										3			2	
C06					3								2	
Avg	3	2	1		3					3		2.5	2	

Activities:

1.	Mathematical Presentation and Report Writing on Engineering Applications of Vector Calculus (C05) Students can choose one application-based problem from vector calculus such as work done by a force field, flux through a surface, verification of Green's theorem, Stoke's theorem or Gauss divergence theorem. They should solve it step by step, interpret the answer and present it with proper mathematical notation, diagram and short report.
2.	Computational Exploration of Matrices, Multiple Integrals, and Vector Fields using Software (C06) Students can use Python, GeoGebra or any open-source mathematical software to solve and visualize problems. Examples include finding eigen values and eigen vectors, diagonalization, plotting functions of two variables, evaluating double/triple integrals, plotting vector fields, and interpreting gradient, divergence and curl.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Selection and understanding of problem	8	Application-oriented problem is clearly selected and concept is correctly explained	Problem is selected properly, but explanation needs minor improvement	Problem selection is basic and conceptual understanding is limited
2.	Mathematical formulation and solution	8	Correct formulation, step-by-step solution and proper use of formulae/theorems	Formulation and solution are mostly correct with minor errors	Formulation is incomplete and solution contains several errors
3.	Interpretation of results	8	Results are clearly interpreted with physical or engineering meaning	Results are interpreted, but explanation is not detailed enough	Interpretation is weak or unclear
4.	Communication, presentation and report writing	8	Neat presentation with correct notation, diagrams and well-structured report	Presentation is understandable, but needs improvement in notation or organization	Presentation is poorly organized and mathematical communication is unclear
5.	Overall analytical approach	8	Work demonstrates excellent analytical thinking and professional academic approach	Analytical approach is good with minor limitations	Analytical approach is satisfactory but lacks depth
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Use of computational tool	8	Appropriate software/tool is selected and used effectively	Tool is used properly, but with minor limitations	Use of tool is limited or not clearly demonstrated
2.	Accuracy of computation and mathematical method	8	Computations are accurate and mathematical method is correctly applied	Computations are mostly correct with minor errors	Computations contain significant errors or method is unclear
3.	Visualization and interpretation	8	Graphs, plots, matrices, vector fields or integral regions are clearly visualized and interpreted	Visualization is given, but interpretation needs improvement	Visualization is incomplete or interpretation is unclear
4.	Report preparation and conclusion	8	Report has objective, procedure, output, interpretation and conclusion	Report is acceptable, but needs better structure or explanation	Report is incomplete or poorly structured

5.	Overall presentation and analytical quality	8	Work demonstrates excellent analytical approach and professional presentation	Analytical quality and presentation are good with minor issues	Analytical quality is satisfactory but lacks depth
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	12	2
CO2	24	24	-	-	24	3
CO3	16	16	-	-	16	2
CO4	8	8	-	-	8	1
CO5	-	-	40	-	25	3
CO6	-	-	-	40	25	3
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26ENC01	COMMUNICATIVE ENGLISH B.E. (Common to all Branches)		SEMESTER				I
Prerequisites		Category	HM	Credits			2
Basic language skills listening, speaking, reading and writing		Hours/ Semester	L	T	P	SL	TH
			45	0	0	15	60
COURSE OBJECTIVES							
1.	To develop integrated Listening, Speaking, Reading, and Writing (LSRW) skills for academic and professional communication.						
2.	To enable learners to comprehend, interpret, and respond to spoken and written texts in technical and workplace contexts.						
3.	To strengthen the use of grammar, vocabulary, and language structures for accurate communication.						
4.	To enhance learners' oral communication skills for discussions, presentations, interviews, and workplace interactions.						
5.	To develop learners' ability to analyze, summarize, report, recommend, and interpret information from texts and real-world data.						
UNIT - I		COMMUNICATION BASICS					9
Listening: Listening to simple conversations, Understanding tone and intent. Speaking: Narrating personal experience and events, Expressing opinions. Reading: Reading for comprehension and specific information, Understanding notices, messages, timetables, graphs etc. Writing: Dialogue writing in a business context. Grammar: Parts of speech - Nouns, Pronouns, Verbs – Main verbs, auxiliary verbs, modal verbs, Adverbs.							
UNIT - II		WORKPLACE COMMUNICATION					9
Listening: Listening to short speeches and TED talks, Extracting information. Speaking: Informal conversation between office colleagues, asking for information to fill details in a form. Reading: Reading technical texts from journals, newspapers and technical blogs. Writing: Writing checklists, Writing recommendations. Grammar: Parts of speech – Adjectives, Conjunctions, Prepositions, Interjections.							
UNIT - III		INTERACTIVE COMMUNICATION					9
Listening: Listening to debates and discussions, Different viewpoints on an issue. Speaking: Role play - customer and sales manager, team leader and team member, interviewer and applicant. Reading: Reading technical description of gadgets – learning the different parts of devices. Writing: Writing instructions, Writing E-mails - Attending workshops, Paper submission for conferences, Arranging a meeting. Grammar: Synonyms, Antonyms, Redundancies, Collocations.							
UNIT - IV		PROFESSIONAL WRITING					9
Listening: Listening to documentaries depicting a technical problem and suggesting solutions. Speaking: Giving a speech, Describing given data, Discussing company information, Summarizing an article. Reading: Reading longer technical texts, Reading biographies and travelogues. Writing: Paragraph writing – Different types of paragraphs, Report Writing – Status reports, Feasibility reports and event reports. Grammar: Conditional statements, Compound words, Sentence completion, Negation in statements and questions.							

UNIT - V		INTERPRETATATION		9
Listening: Listening to informal communication and longer technical talks. Speaking: Qualities required for employability, Improving employee’s productivity, teamwork, creativity and leadership quality. Reading: Reading brochures, telephone messages, social media messages relevant to technical contexts. Writing: Mind maps, Charts - interpreting statistical data, charts, graphs and tables. Grammar: One word substitution, Abbreviations and acronyms in technical context, Technical vocabulary, Idioms.				
L:45, SL:15, Total:60 Hours				
Weightage: Continuous Assessment - 40% End Semester Examinations - 60%				
REFERENCE BOOKS:				
1.	Sharma, S., and B. Mishra. <i>Communication Skills for Engineers and Scientists</i> . 2nd ed., PHI Learning, 2024.			
2.	Miller, Katherine Q., and Susan T. Wahl. <i>Business and Professional Communication: KEYSfor Workplace Excellence</i> . 5th ed., SAGE Publications, 2023.			
3.	Viswamohan, Aysha. <i>English for Technical Communication</i> . McGraw-Hill Education, 2013.			
4.	Raman, Meenakshi, and Sangeeta Sharma. <i>Technical Communication: Principles andPractice</i> . 3rd ed., Oxford University Press, 2015.			
5.	Rizvi, M. Ashraf. <i>Effective Technical Communication</i> . McGraw Hill Education India, 2017.			
E-RESOURCES:				
1.	https://learnenglish.britishcouncil.org/			
2.	https://www.bbc.co.uk/learningenglish/			
3.	https://www.ted.com/talks			
4.	https://www.cambridgeenglish.org/			
5.	https://www.toastmasters.org/			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Explain the fundamentals of listening, speaking, reading, and writing (LSRW) skills for effective academic and workplace communication.		PO9, PO11	
CO2	Apply appropriate grammar, vocabulary, sentence structures, and language conventions to communicate accurately in technical and professional contexts.		PO9, PO11	
CO3	Demonstrate effective oral communication skills through discussions, presentations, interviews, debates, and workplace interactions with confidence and clarity.		PO9, PO11	PSO1
CO4	Analyze technical and professional texts, reports, charts, and workplace documents to interpret, summarize, and present relevant information effectively.		PO9, PO11	
CO5	Develop professional writing skills for drafting reports, emails, proposals, status reports, feasibility reports, and other workplace documents.		PO9, PO10, PO11	PSO3

[illegible]

	(iv) Community Outreach / Social Responsibility Project: Attend workshops, organize awareness campaigns, literacy drives, environmental programs, or social initiatives emphasizing teamwork, leadership, and ethical responsibility. (v) Problem-Solving Case Study Presentation: Analyze real-time workplace or ethical case studies and present solutions collaboratively using leadership, communication, and decision-making skills.
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Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Understanding of Purpose and Audience	10	Clearly identifies the purpose, context, and target audience; content is highly relevant	Purpose and audience are identified with minor gaps in relevance	Purpose and audience are inadequately addressed
2.	Content Development and Organization	10	Content is comprehensive, logically organized, and professionally structured	Content is organized with minor omissions or inconsistencies	Content lacks organization and completeness
3.	Professional Writing and Communication	10	Uses appropriate tone, style, and workplace conventions effectively	Generally appropriate tone and style with minor errors	Tone, style, or workplace conventions are inappropriate or unclear
4.	Language, Formatting, and Accuracy	10	Excellent grammar, vocabulary, formatting, and document presentation with no significant errors	Minor grammatical, formatting, or language errors	Frequent errors in grammar, formatting, and presentation affecting readability
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Communication Skills	10	Communicates ideas clearly, confidently, and effectively using appropriate verbal and non-verbal communication	Communicates ideas adequately with minor clarity or delivery issues	Communication is unclear, hesitant, or ineffective
2.	Interpersonal and Teamwork Skills	10	Demonstrates excellent collaboration, active listening, respect for others, and conflict resolution skills	Participates effectively in teamwork with occasional guidance	Limited participation and difficulty in working with others

3.	Leadership and Decision-Making	10	Shows initiative, responsibility, problem-solving ability, and effective leadership in group activities	Demonstrates leadership qualities with minor limitations	Shows limited initiative and leadership ability
4.	Ethical, Social, and Professional Responsibility	10	Consistently demonstrates ethical behaviour, professionalism, accountability, and social responsibility	Demonstrates responsibility and professionalism with minor lapses	Shows inadequate awareness of ethical or professional responsibilities
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12			12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26PHC01	APPLIED PHYSICS			SEMESTER			I
Prerequisites		Category	BS	Credits			4
		Hours/ Semester	L	T	P	SL	TH
			45	0	45	30	120
COURSE OBJECTIVES							
1.	To understand the fundamental principles of mechanics and rotational motion.						
2.	To analyze ultrasonic wave production, detection, and applications.						
3.	To develop conceptual understanding of quantum mechanics and nanoscale systems.						
4.	To understand the fundamental principles of laser operation, laser characteristics and different types of laser.						
5.	To understand the principles of optical fiber transmission and communication system for high-speed data transmission.						
UNIT - I	MECHANICS						9+9
Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia – Theorems of moment of inertia – Moment of inertia of diatomic molecule – Torque – Rotational dynamics of rigid bodies – Conservation of angular momentum – Rotational energy state of a rigid diatomic molecule – gyroscope – Torsional pendulum – Introduction to nonlinear oscillations. Practical: 1. Torsional Pendulum – Determination of rigidity modulus of the given material 2. Determination of moment of inertia of a rigid body Activity: Virtual demonstration of Gyroscopic Motion							
UNIT - II	ULTRASONICS						9+9
Properties - Production: Magnetostriction effect - Magnetostriction generator - Piezoelectric effect – Piezoelectric generator – Detection of ultrasonic waves - Cavitation– Acoustical grating– Velocity measurement – Industrial Applications: SONAR – Non Destructive Testing: Pulse echo system through transmission and reflection modes – Medical application - Sonogram Practical: 1. Ultrasonic interferometer – Determination of velocity of ultrasonic waves and compressibility of given liquid 2. Acoustical Grating - Determination of velocity of ultrasonic waves in a given liquid Activity: Virtual demonstration of SONAR.							
UNIT - III	QUANTUM MECHANICS						9+9
Matter waves – Experimental evidence - Davisson and Germer experiment – Schrodinger’s wave equation - Time independent and dependent equations – Physical significance of wave function – Normalization – Particle in an infinite potential well (1D) – Tunnelling effect (Qualitative) – Scanning Tunnelling Microscope (STM). Practical: 1. Quantum Mechanics of Particle in a Potential Well – simulation 2. Quantum tunnelling through a potential barrier – simulation Activity: Virtual demonstration of Scanning Tunnelling Microscope							

UNIT - IV	LASER	9+9
Characteristics of laser light – absorption, spontaneous emission and stimulated emission – Einstein Co-efficient (derivation) – Population inversion – Pumping methods – Types of laser – Construction and working of Nd:YAG laser, CO₂ Laser, Semiconductor laser (homojunction and heterojunction) – Industrial and medical applications(Qualitative). Practical: 1. Determination of wavelength of laser using grating 2. Determination of particle size using laser Activity: Virtual demonstration of semiconductor laser		
UNIT - V	FIBRE OPTICS	9+9
Principle of optical fibre – Structure – Critical angle – Propagation of light through optical fibre – Numerical aperture and Acceptance angle – Classification of optical fibre – Fibre optic communication (Block diagram) – Fibre optic sensors: Displacement and Temperature Sensor - Medical Application- Fibre optic endoscope. Practical: 1. Determination of Acceptance angle and Numerical aperture of a given fibre 2. Determination of displacement using fibre optics sensor Activity: Virtual demonstration of fibre optic sensors		
L:45, P:45, SL:30, Total:120 Hours		
Weightage: Continuous Assessment 50% End Semester Examinations 50%		
TEXT BOOKS:		
1.	A. Marikani, 'Engineering Physics', PHI Learning Publishers, 2024.	
2.	M.Arumugam, 'Engineering Physics', Anuradha Publications, 2014.	
3.	R.K. Gaur & S.L. Gupta, 'Engineering physics', Dhanpat Rai Publications, 2022.	
4.	B.B. Laud, 'Lasers and Non-linear Optics', New Age international Publishers, 2021.	
REFERENCE BOOKS:		
1.	H.D. Young & R.A. Freedman, 'University physics with modern physics', Pearson, 2020.	
2.	Arthur Beiser, 'Concepts of Modern Physics', McGraw-Hill, 2017.	
3.	K. Thyagarajan and Ajoy Ghatak, ' <i>Lasers: Theory and Applications</i> ', Springer, 2012.	
E-RESOURCES:		
1.	Ultrasonics: https://nptel.ac.in/courses/122107035	
2.	CO ₂ Laser: https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ph03	
3.	Quantum Mechanics: https://www.youtube.com/playlist?list=PL0F530F3BAF8C6FCC	
4.	Optical Sensors: https://auece.digimat.in/nptel/courses/video/108106173/L02.html	

COURSE OUTCOMES (COs) At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Explain the fundamental principles and concepts of applied physics and their engineering applications.	--	
CO2	Apply physics principles to solve problems encountered in engineering context	PO1	
CO3	Analyse the solution strategies for applied physics problems, selecting appropriate approaches based on theoretical and practical considerations.	PO2	
CO4	Perform practical experiments and activity-based demonstrations in groups and present the observed results.	PO4, PO8	
CO5	Communicate emerging concepts and advancements in physics while considering environmental sustainability and societal impact through virtual laboratory activities and seminar presentations.	PO6, PO9	PSO3
CO6	Engage in self-learning to explore emerging physics concepts, advanced technologies, and contemporary engineering applications, fostering continuous professional development.	PO11	

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2	2													
CO3		3												
CO4				3				3						
CO5						2			2					2
CO6											2			

Activities:

1.	Determination of physics concepts through virtual lab. (CO5) Seminar presentation of emerging physics concepts. (CO5)
2.	Self-learning study and presentation on emerging physics-based technologies with safety considerations. (CO6)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Subject Knowledge	10	Clearly explains the concept with relevant examples	Good explanation with minor gaps	Basic understanding of the topic
2.	Content Organization	10	Information is well-organized, clear, and logically presented	Organization is good with minor improvements needed	Average organization of content

3.	Communication Skills	10	Confident presentation with clear explanation and effective response to questions	Good communication with slight hesitation	Basic communication skills
4.	Interpretation of Results	10	Results are accurately analyzed, clearly interpreted, and well justified using scientific principles.	Results are interpreted correctly with some justification	Basic interpretation of results with limited analysis or justification.
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Topic Understanding	10	Clearly explains the concept and its real-world application with relevant details	Good explanation with minor gaps	Basic understanding of the topic
2.	Literature Review	10	Reviews and compares multiple relevant research articles effectively	Reviews relevant articles with some comparison	Limited review of articles
3.	Analysis & Interpretation	10	Critically analyses the product performance, advantages, and limitations	Good analysis with minor shortcomings	Basic analysis provided
4.	Presentation & Communication	10	Well-organized report/presentation with clear communication and proper references	Organized presentation with minor errors	Average presentation and communication
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

	Theory Component				Laboratory Component		Percentage allocation	Mapping Strength
CO	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
CO1	12	12					6	1
CO2	24	24					12	2
CO3	24	24			40	40	32	3
CO4					60	60	30	3
CO5			40				10	2
CO6				40			10	2
Total	60	60	40	40	100	100	100	

Note: Strength = 3 (if percentage >20%); Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26CYC01	APPLIED CHEMISTRY			SEMESTER			I	
Prerequisites			Category	BS	Credits			4
Basic Chemistry concepts			Hours/ Semester	L	T	P	SL	TH
				45	0	45	30	120
COURSE OBJECTIVES								
1.	To understand the fundamental scientific principles related to water chemistry, electrochemical systems, polymers, acid–base equilibria, corrosion phenomena, and spectroscopic techniques used in engineering applications.							
2.	To acquire the ability to apply chemical laws, numerical methods, and analytical reasoning for solving engineering problems involving water quality, electrochemical cells, buffer systems, corrosion, and instrumental analysis.							
3.	To examine the behaviour of chemical and material systems and interpret the influence of process parameters on performance in water treatment, electrochemical processes, corrosion control, polymers, and spectroscopy.							
4.	To assess different engineering materials, chemical processes, and analytical techniques for selecting suitable methods in industrial and technological applications.							
5.	To develop practical laboratory skills by performing experiments related to water analysis, electrochemistry, polymers, acid–base systems, corrosion studies, and spectroscopic measurements, and to interpret experimental data effectively.							
UNIT - I		WATER TECHNOLOGY:						9+9
Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – dissolved oxygen significance – boiler troubles (scale and sludge, priming and foaming, caustic embrittlement and boiler corrosion) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) – External treatment – demineralization, zeolite process – desalination of brackish water – reverse osmosis. Practical: 1. Estimation of total hardness by EDTA method. 2. Estimation of alkalinity of water. Activities: 1. Determination of DO by Winkler titration. 2. Coagulation of water by adding alum.								
UNIT - II		ELECTROCHEMISTRY						9+9
Cells – types – Electrochemical cell – representation of electrochemical cell – redox reaction – single electrode potential – oxidation and reduction potential – Nernst equation for single electrode potential – numerical problems. Electrochemical series – significance and application – measurement of emf of cell – poggendorff's method. Potentiometric titrations (acid-base, redox and precipitation titrations). Practical: 1. Estimation of iron by potentiometric titration. 2. Estimation of strong acid by conductometric titration. 3. Estimation of mixture of acids by conductometric titration. Activity: Electrochemical cell demonstration								
UNIT - III		POLYMERS AND PHASE RULE						9+9
Polymers – definition – polymerization – types – addition and condensation polymerization – mechanism of free radical addition polymerization – plastics, classification – thermosetting and thermo plastic – preparation, properties and uses of PVC, Teflon, polyurethane, nylon-6,6, PET. Phase rule – Introduction, definition of terms with examples, one component system – water system. Practical: Determination of molecular weight of polymer by viscometry. Activity: Comparing biodegradable and non-biodegradable polymers.								

UNIT - IV	ACID BASE CONCEPTS AND CORROSION	9+9
Acids and bases – Arrhenius concept – Bronsted-Lowry concept – Lewis concept – pH and pKa – buffer solutions – types – mechanism of buffer action – Henderson–Hasselbalch equation – derivation and problems. Corrosion – causes – types of corrosion – chemical, electrochemical corrosion (galvanic, differential aeration) – factors influencing the rate of corrosion – electrochemical protection – sacrificial anode method and impressed current cathodic method. Practical: 1. Estimation of strong acid by pH meter. 2. Estimation of pKa of weak acid by pH meter. Activities: 1. Using litmus paper finding out the nature (acid or base) of household substances. 2. Corrosion study by weight loss method		
UNIT - V	SPECTROSCOPIC TECHNIQUES	9+9
Beer-Lambert's law (problem) – UV visible spectroscopy: Principle, chromophore, auxochrome, electronic transitions and instrumentation (No applications). Flame photometry – principle – instrumentation – estimation of sodium by flame photometer. Atomic absorption spectroscopy – principle – instrumentation – estimation of nickel by atomic absorption spectroscopy. Practical: 1. Estimation of iron by spectrophotometer. 2. Estimation of copper by calorimeter. Activity: Determining chlorophyll content in leaves with aspectrophotometer.		
L:45, P:45, SL :30, Total:120 Hours		
Weightage: Continuous Assessment 50% End Semester Examinations 50%		
REFERENCE BOOKS:		
1.	S. S. Dara and S. S. Umare, —A Textbook of Engineering Chemistry S. Chand & Company LTD, New Delhi, 2015	
2.	P. C. Jain and Monika Jain, —Engineering Chemistry Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015	
3.	S. Vairam, P. Kalyani and Suba Ramesh, —Engineering Chemistry Wiley India PVT, LTD, New Delhi, 2013.	
4.	Dr.Shashi Chawla - A Textbook of Engineering Chemistry - Dhanpat Rai & Co. (Pvt.) Ltd., New Delhi - 2001	
5.	Dr. O. G. Palanna - Engineering Chemistry - McGraw-Hill Education (India) Private Limited - 2009	
E-RESOURCES:		
1.	www.onlinecourses.nptel.ac.in/	
2.	www.ePathshala.nic.in	
3.	eGyanKosh – IGNOU Repository (http://egyankosh.ac.in) – ID: 123456789/43343	
4.	Royal Society of Chemistry Education (https://edu.rsc.org)	
5.	MIT OpenCourseWare (https://ocw.mit.edu)	

COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Explain the fundamental principles of water chemistry, electrochemical systems, polymers, phase equilibria, acid–base concepts, corrosion processes, and spectroscopic techniques relevant to engineering applications.	---	---
CO2	Apply chemical laws, mathematical relationships, and analytical methods to solve engineering problems related to water quality analysis, electrochemical systems, buffer solutions, corrosion, and spectroscopic measurements.	PO1	---
CO3	Analyze chemical systems and engineering problems by correlating theoretical principles with material behaviour, process performance, and experimental observations in water treatment, electrochemistry, corrosion, polymers, and spectroscopy.	PO2	---
CO4	Perform laboratory experiments based on water quality parameters, electrochemical processes, polymer properties, acid–base equilibria, corrosion mechanisms, and spectroscopic analysis.	PO4, PO8	---
CO5	Execute activity-based investigations related to water analysis, acid–base systems, corrosion studies, polymer characterization, and spectroscopic techniques, and interpret the results using standard analytical methods.	PO5, PO8	---
CO6	Engage in self-learning activities to understand and explore the role of chemical principles, materials, and analytical techniques in water treatment, corrosion control, polymers, electrochemical systems, and spectroscopy, and present the findings in engineering applications.	PO9, PO11	---

The Course Articulation Matrix (CAM) for defined COs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1														
CO2	2													
CO3		2												
CO4				3				3						
CO5					2			2						
CO6									2		2			

Activities:

1.	Undertake experimental studies and virtual/self-learning activities on water treatment, acid–base systems, corrosion, polymers, and spectroscopy, and report the observations and conclusions. (CO5) (Individual and Collaborative Team Work)
2.	Engage in self-learning and evaluated through quizzes, case studies, seminars, and presentations on the application of chemical principles, materials, and analytical techniques in engineering systems. (CO6) (Independent study)

Rubrics for evaluation: C05

Sl. No	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Understanding of Concept	10	Understanding of the concept with clear explanations.	Understanding with minor errors or omissions.	Shows basic understanding but with significant gaps or misconceptions.
2.	Team Participation and Collaboration	10	Actively contributes, collaborates effectively, and supports team members throughout the activity.	Participates regularly and contributes to team tasks with moderate involvement.	Limited participation and contribution to team activities.
3.	Interpretation of Results	10	Results are accurately analyzed, clearly interpreted, and well justified using scientific principles.	Results are interpreted correctly with some justification.	Basic interpretation of results with limited analysis or justification.
4.	Response to Questions	10	Answers questions accurately and effectively.	Answers most questions correctly.	Answers questions with partial accuracy.
	Total	40			

Rubrics for evaluation: C06

Sl. No	Criterion	Marks	Excellent (4)	Good(3)	Satisfactory (2)
1.	Conceptual Clarity and Knowledge	10	Shows complete conceptual clarity with strong understanding and accurate knowledge.	Shows good conceptual clarity with minor errors.	Basic understanding with limited clarity and several gaps.
2.	Accuracy of Content / Answers	10	All answers are correct, precise, and scientifically accurate.	Most answers are correct with minor mistakes.	Some correct answers but several errors present.
3.	Application and Analytical Thinking	10	Effectively applies concepts to solve problems and analyze situations.	Applies concepts with minor difficulty in analysis.	Limited ability to apply concepts; mostly descriptive.
4.	Participation and Preparedness	10	Fully prepared, actively participates, and demonstrates strong engagement throughout the activity.	Well prepared and participates actively with minor gaps.	Partially prepared with limited participation or engagement.
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

	Theory Component				Laboratory Component		Percentage allocation	Mapping Strength
CO	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
C01	12	12					6	1
C02	24	24					12	2
C03	24	24					12	2
C04					100	100	50	3
C05			40				10	2
C06				40			10	2
Total	60	60	40	40	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26CSC01	C PROGRAMMING (Common to All Branches)		SEMESTER				I
Prerequisites		Category	ES(G)	Credits			4
NIL		Hours/ Semester	L	T	P	SL	TH
			45	0	30	45	120
COURSE OBJECTIVES							
1.	To provide students with fundamental knowledge of C programming concepts, syntax, data types, operators, and control structures for developing computational solutions.						
2.	To develop logical thinking and problem-solving abilities through algorithm design, flowcharts, and structured programming techniques.						
3.	To enable students to design and implement modular programs using functions, arrays, pointers, strings, and user-defined data types in C.						
4.	To enhance students' debugging, testing, and program analysis skills for developing efficient and reliable software solutions.						
5.	To prepare students to apply C programming concepts in engineering applications, real-world problem solving, and further advanced computing courses.						
UNIT - I		C PROGRAMMING BASICS					9+6
Introduction to C programming- C program structure- Program Compilation and Execution- Language processing systems-Problem Solving Strategies-Algorithm-Flow Chart- Character Set- Identifiers& keywords- Data Types, Enumerations- Type conversions- Input & output statements in C – Operators- Preprocessor Directives (#include and #define): Macros. Practical Component: Develop simple C programs using basic programming constructs, input/ output operations and operators. Create algorithms, flowcharts and pseudocode for problem solving.							
UNIT - II		CONTROL STATEMENTS					9+6
Making decisions: If statement- if / else statement- if/else if statement- Nested if statements- dangling else- Switch Multiple Selection Statement- Repetition: Repetition essentials- while loop- do- while Loop- for loop- Nested loops- Breaking out of a loop- continue statement- go to statement. Practical Component: Develop programs using decision-making statements, looping constructs, control transfer statements.							
UNIT - III		FUNCTIONS					9+6
Modular Programming- Function prototypes – Defining and Calling functions: Call by Value, Call by Address- Function call stack and Activation Records- Passing Arguments to Functions- Returning a value from a function- Recursion – Recursion Vs. Iteration- Scope and life time of variables- Memory layout of a C program- Storage Classes – Auto – Static – Extern and Register Variables. Practical Component: Implement programs using functions, parameter passing techniques, recursive functions, storage classes.							
UNIT - IV		ARRAYS, POINTERS AND STRINGS					9+6
Defining Array- Array Initialization- Accessing array elements- Processing Arrays- Multidimensional arrays- memory address calculation of an array- Row major and column major order- Pointers – Pointer Declaration- Operations on Pointer- Function pointer -Relation between pointers and arrays- String Handling Practical Component: Develop programs using arrays, strings and pointers.							

UNIT - V		STRUCTURES, UNION AND DATA FILES		9+6
Defining and processing a structure, Nested structures, passing structure to functions – Array of structure, Pointer to structure – Union – Dynamic memory allocation – Files: Streams, Opening and closing a file, Reading and writing a file.				
Practical Component: Develop programs using structures, unions and file handling operations.				
Total (45 L+ 30 P+ 45 SL) = 120 Periods				
Weightage: Continuous Assessment 50% End Semester Examinations 50%				
TEXT BOOK:				
1.	H.M. Deitel and P.J. Deitel, ' <i>C: How to Program</i> '. 9th edition, Pearson, New Delhi, 2022.			
2.	Herbert Schildt, ' <i>C: The Complete Reference</i> '. 4th edition, McGraw Hill, Noida, 2017.			
REFERENCE BOOKS:				
1.	Pradip Dey and Manas Ghosh, ' <i>Programming in C</i> '. Oxford University, New Delhi, 2018.			
2.	Mike McGrath, ' <i>C Programming In Easy Steps Limited</i> '. 5th edition, United Kingdom, 2018.			
3.	B.W. Kernighan and D.M. Ritchie, ' <i>The C Programming Language</i> '. 2nd edition, Pearson, New Delhi, 2015.			
4.	Yashavant P. Kanetkar "Let Us C", BPB Publications., 2017, 16th edition			
E-RESOURCES:				
1.	"Introduction to C Programming", Swayam MOOC Course, - https://onlinecourses.swayam2.ac.in/imb25_mg71/			
2.	GeeksforGeeks - C Programming - https://www.geeksforgeeks.org/c-programminglanguage/			
3.	Learn - C.org - https://www.learn-c.org/			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Explain the fundamentals and core concepts of C programming.		--	PSO1
CO2	Apply programming skills to develop C programs for the given problem statement/mathematical equation.		PO1	PSO1
CO3	Analyze the given C program and debug/predict its output.		PO2	PSO1
CO4	Develop and execute C programs to represent, compute, and solve mathematical equations or specified parameters.		PO3	PSO1
CO5	Illustrate the applications of C programming concepts in solving computational problems through individual learning activities.		PO6, PO9, PO11	PSO1
CO6	As a member of a team, identify and formulate programming problems, and develop, implement, and demonstrate appropriate solutions using suitable C programming concepts, techniques, and tools while abiding by ethics.		PO5, PO8, PO11	PSO1

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	2	-	-	2	-	2	2	-	-
CO6	-	-	-	-	3	-	-	3	-	-	2	2	-	-

Activities:

1.	Technical Quiz / MCQ-Based Assessment (CO5)
2.	Hackathon / Coding Challenge Participation / Team-Based Activities (CO6)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Conceptual Understanding	10	Thorough understanding of concepts	Moderate understanding	Basic understanding
2.	Accuracy in Responses	10	Answers almost all correctly	Answers most correctly	Answers few correctly
3.	Logical Reasoning Ability	10	Strong analytical ability	Moderate reasoning ability	Limited reasoning ability
4.	Time Management	5	Completes within time confidently	Moderate reasoning ability	Unable to complete on time
5.	Participation and Preparedness	5	Highly active and well prepared	Moderately prepared	Limited participation
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Team Participation and Collaboration	10	Actively contributes and collaborates effectively with team members	Participates with moderate contribution	Limited participation in team activities
2.	Problem Solving Ability	10	Develops efficient and innovative solutions for the given problem	Develops acceptable solutions with minor issues	Unable to develop complete solutions
3.	Coding and Implementation Skills	10	Writes correct, efficient, and well-structured programs	Writes functional programs with few errors	Programs contain major errors/incomplete implementation

4.	Creativity and Innovation	5	Demonstrates creative thinking and innovative ideas	Shows moderate creativity	Limited creativity in approach
5.	Presentation and Demonstration	5	Clearly explains and demonstrates the solution confidently	Provides moderate explanation and demonstration	Unable to explain or demonstrate effectively
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Theory Component				Laboratory Component		Percentage Allocation	Mapping Strength
	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
CO1	12	12					6	1
CO2	24	24			70	70	47	3
CO3	12	12			20	20	16	2
CO4	12	12			10	10	11	2
CO5			40				10	2
CO6				40			10	2
Total	60	60	40	40	100	100	100	

Note: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10)

26HMC01	தமிழர் மரபு B.E. (Common to all Branches)		பருவம்			I	
முன்நிபந்தனைகள்		Category	HM	Credits		1	
இலக்கணம் மற்றும் இலக்கியத்தின் அடிப்படைகள்		Hours/ Semester	L	T	P	SL	TH
			15	0	0	15	30
பாட நெறி நோக்கங்கள்							
1.	தமிழ்மொழி மற்றும் இலக்கியம் பற்றிய அறிவைப் பெற முடியும்.						
2.	பாரம்பரியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் மற்றும் சிற்பக்கலைகள் பற்றி தெரிந்து கொள்ள முடியும்.						
3.	நாட்டுப்புறக்கலைகள் மற்றும் வீர விளையாட்டுகள் பற்றி அறிந்து கொள்ளமுடியும்.						
4.	தமிழர்களின் ஒழுக்க நெறிமுறைகளைப் பற்றி தெரிந்து கொண்டு அதன்படி நடந்து கொள்ள முடியும்.						
5.	பழங்கால இந்திய தேசிய இயக்கம் பற்றியும், இந்தியமக்களின் பண்பாட்டில் தமிழர்களின் பங்களிப்பு பற்றியும் நன்கு அறிந்து கொள்ள முடியும்.						
அலகு - I மொழி மற்றும் இலக்கியம்:							
						3	
இந்திய மொழிக்குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் -சங்க இலக்கியத்தின் சமயசார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மை கருத்துக்கள் - தமிழ்க்காப்பியங்கள், தமிழகத்தில் சமணபௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி- தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.							
அலகு - II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை							
						3	
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன்சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் - தேர்செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப் புறத்தெய்வங்கள் - குமரி முனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.							
அலகு - III நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள்							
						3	
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம், தோல் பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.							
அலகு - IV தமிழர்களின் திணைக் கோட்பாடுகள்							
						3	
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கொப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும்- சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.							

அலகு - V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3
இந்திய விடுதலை போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சுவரலாறு.		
L:15, SL:15, Total:30 Hours		
மதிப்பீட்டு விகிதம்: தொடர்மதிப்பீடு: 40% பருவ இறுதித்தேர்வுகள்: 60%		
குறிப்பு நூல்கள்:		
1.	தமிழக வரலாறு - மக்களும் பண்பாடும்- கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)	
2.	கணினித்தமிழ்- முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)	
3.	கீழடி- வைகை நதிகரையில் சங்ககால நகரநாகரீகம் (தொல்லியல்துறை வெளியீடு)	
4.	பொருநை - ஆற்றங்கரைநாகரீகம் (தொல்லியல்துறைவெளியீடு)	
5.	முத்திராமலிங்கம் சு. & சரவணகுமார்மு. "தமிழர்மரபு) Heritage of Tamils)", 2023 Yes Dee Publishing Pvt. Ltd., சென்னை.	
மின்னணுவளங்கள்:		
1.	https://en.wikipedia.org/wiki/Dravidian_languages	
2.	https://www.tamilvu.org/courses/degree/	
3.	https://www.scribd.com/document/802136891/Heritage-of-Tamils	
4.	https://www.scribd.com/document/718189396/AKAM-AND-PURAM	
5.	https://pmc.ncbi.nlm.nih.gov/articles/PMC10357311/	
பாடநெறிமுடிவுகள் (COs) / இந்தப்படிப்பு முடிந்ததும், மாணவர்களால்		Mapping POs
CO1	இந்திய மொழிகள், மொழிக்குடும்பங்கள், இலக்கியத்தின் தோற்றம் மற்றும் வளர்ச்சி ஆகியவற்றை விளக்குவதோடு, தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்புகளை மதிப்பிடுவார்கள்.	PO9
CO2	பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை தமிழர்களின் கலை மரபுகளை அறிந்து, தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் கோவில்களின் பங்கை விளக்குவார்கள்.	PO9

C03	தமிழர்களின் வாழ்வியல் முறைகளோடு தொடர்புடைய நாட்டுப்புறக்கலைகள், வீரவிளையாட்டுகள் மற்றும் சங்ககாலத்திணைக் கோட்பாடுகளைப் புரிந்து கொண்டு அவற்றின் பண்பாட்டு முக்கியத்துவத்தை எடுத்துரைப்பார்கள்.	PO9	PSO1
C04	இந்திய தேசிய இயக்கத்திலும் இந்தியப்பண்பாட்டு வளர்ச்சியிலும் தமிழர்களின் பங்களிப்பை ஆய்ந்து அதன் வரலாற்றுச் சிறப்பை விளக்குவார்கள்.	PO9	-
C05	இந்திய மொழிகள், இலக்கிய வளர்ச்சி, தமிழ் இலக்கிய அறிஞர்களின் பங்களிப்புகள், சங்ககாலத்திணைக் கோட்பாடுகள் ஆகியவற்றை அடிப்படையாகக் கொண்டு கருத்தரங்குகள், விளக்கவுரைகள், குழு விவாதங்கள் மற்றும் திட்டப்பணிகளை மேற்கொண்டு தங்களது பகுப்பாய்வுத்திறனை வெளிப்படுத்துவார்கள்.	PO9, PO11	PSO3
C06	தமிழர்களின் கலை, பண்பாடு, நாட்டுப்புறக்கலைகள், வீரவிளையாட்டுகள், கோவில் மரபுகள் மற்றும் தேசிய இயக்கத்தில் தமிழர்களின் பங்களிப்பு தொடர்பான கள ஆய்வு, ஆவணப்படுத்தல், படைப்பாற்றல் செயல்பாடுகள் மற்றும் வழங்கல்களின் மூலம் பண்பாட்டு விழிப்புணர்வு மற்றும் ஆய்வுத்திறன்களை வளர்த்துக் கொள்வார்கள்.	PO9, PO11	PSO3

வரையறுக்கப்பட்ட பாடக் கற்றல் விளைவுகளுக்கான பாட ஒருங்கிணைப்பு அட்டவணை (CAM)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01									3					
C02									3					
C03									3			2		
C04									3					
C05									3		2			2
C06									3		2			2

செயல்பாடுகள்:

	C05: தமிழர்களின் பாரம்பரிய அறிவியல் அறிவு, தொழில்நுட்பச் சாதனைகள் மற்றும் பண்பாட்டு மரபுகளை ஆராய்ந்து, அவற்றின் வரலாற்று மற்றும் தற்கால முக்கியத்துவத்தைப் புரிந்து கொள்வார்கள். செயல்பாடுகள்: 1. பழந்தமிழர்களின் அறிவியல் மற்றும் தொழில்நுட்பச் சாதனைகள் (எ.கா., நீர்ப்பாசன அமைப்புகள், கட்டிடக்கலை, உலோகவியல், கடல்சார்வாணிபம்) குறித்த கருத்தரங்கு வழங்கல். 2. பாரம்பரியத்தமிழ் அறிவு முறைகளின் தற்காலப் பயன்பாடு மற்றும் முக்கியத்துவம் குறித்த குழு விவாதம்.
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	3. தமிழர் பண்பாட்டு மரபுச் சின்னங்கள், வரலாற்று நினைவுச் சின்னங்கள் மற்றும் பொறியியல் அற்புதங்கள் தொடர்பான வழக்குக்கள் ஆய்வு (Case Study Analysis). 4. தமிழர்களின் பண்பாட்டு மற்றும் தொழில் நுட்பப்பங்களிப்புகளை எடுத்துக்காட்டும் வகையில் விளக்கப்படங்கள், மாதிரிகள் மற்றும் புகைப்படங்களைக் கொண்டு பாரம்பரியக் கண்காட்சி நடத்துதல், தமிழர் இலக்கியம், அறிவியல் மற்றும் பண்பாட்டுச் சாதனைகள் குறித்த வினாடி வினா மற்றும் பட்டிமன்றம் / விவாதம் நடத்துதல் 5. அருங்காட்சியகங்கள், பாரம்பரியத்தளங்கள், கோவில்கள் அல்லது தொல்லியல் தளங்களுக்கு களப்பயணம் மேற்கொண்டு ஆய்வறிக்கை சமர்ப்பித்தல்.
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2.	CO6: தமிழர்களின் அறிவியல், தொழில் நுட்ப மற்றும் பண்பாட்டுப்பங்களிப்புகளின் பயன்பாடுகளையும் அவற்றின் தற்காலப் பொருத்தத்தையும் செயல் வழிக்கற்றல், வழக்குக்கள் ஆய்வுகள் மற்றும் திட்டப்பணிகள் மூலம் வெளிப்படுத்துவார்கள். செயல்பாடுகள்: 1. தமிழர்களின் பாரம்பரியத் தொழில் நுட்பங்கள் (நீர்மேலாண்மை, வேளாண் முறைகள், பாரம்பரியக் கட்டிடக்கலை போன்றவை (தொடர்பான சிறுதிட்டப்பணி (Mini Project) மேற்கொள்ளுதல். 2. தமிழர் பொறியியல் சாதனைகளை (எ.கா., கல்லணை, கோவில்கட்டிடக்கலை, பண்டைய கடற்படைக் கப்பல்கள் (விளக்கும் மாதிரி வடிவமைத்தல்) Model Making Activity). 3. பண்டைய தமிழர் தொழில் நுட்பங்களையும் நவீனதொழில் நுட்பங்களையும் ஒப்பிட்டு வழக்குக்கள் ஆய்வு வழங்கல் (Case Study Presentation) மேற்கொள்ளுதல். 4. பாரம்பரியக்கலைகள், கைவினைப்பொருட்கள், நாட்டுப்புற நடைமுறைகள் அல்லது பூர்வீகத் தொழில்நுட்பங்கள் தொடர்பான செயல் விளக்கக்காட்சி) Practical Demonstration) நடத்துதல். 5. தமிழர்களின் அறிவியல் மற்றும் தொழில்நுட்பப் பங்களிப்புகளை எடுத்துரைக்கும் சுவரொட்டி (Poster) மற்றும் தகவல் விளக்கப்படம் (Infographic) தயாரித்தல், உள்ளூர் பாரம்பரிய அறிவு, நாட்டுப்புறப் பழக்க வழக்கங்கள் அல்லது பண்பாட்டு மரபுகள் தொடர்பான சமூக அடிப்படையிலான ஆய்வுத்திட்டம் மேற்கொண்டு அதன் முடிவுகளை வழங்குதல்.
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CO5-க்கான மதிப்பீட்டு அளவு கோல்கள்

வரி சை எண்	மதிப்பீட்டு அளவுகோல்	மதிப் பெண் கள்	மிகச்சிறப்பு (7-8)	சிறப்பு (4-6)	திருப்திகரம் (1-3)
1.	தமிழர் பாரம்பரியம் குறித்த அறிவு	8	தமிழர்களின் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டு மரபுகள் குறித்து துல்லியமான விவரங்களுடன் விரிவான புரிதலை வெளிபடுத்துகிறார்.	சிறிய குறைபாடுகளு டன் நல்ல புரிதலை வெளிபடுத்துகி றார்.	வரையறுக்கப்பட்ட விவரங்களுடன் அடிப்படைப்புரித லை வெளிபடுத்துகிறார்

2.	வரலாற்றுப்புரிதல்	8	வரலாற்றுப் பின்னணி மற்றும் அதன் முக்கியத்துவத்தைபொருத்தமானஎடுத்துக்காட்டுகளுடன் தெளிவாகவிளக்குகிறார்.	சிலஎடுத்துக்காட்டுகளுடன்வரலாற்றுப்பின்னணியைவிளக்குகிறார்.	வரலாற்றுப்பின்னணியைகுறைந்தஅளவில்விளக்குகிறார்.
3.	தற்காலப்பொருத்தம்	8	பாரம்பரிய அறிவு மற்றும் சாதனைகளை இன்றைய பயன்பாடுகள் மற்றும் பிரச்சினைகளுடன் திறம்பட தொடர்புபடுத்துகிறார்.	பாரம்பரிய அறிவை நவீன பயன்பாடுகளுடன் ஓரளவு தெளிவாக தொடர்புபடுத்துகிறார்.	சில நவீன தொடர்புகளை மட்டுமே அடையாளம்காண்கிறார்.
4.	வழங்கல்மற்றும்தொடர்புத்திறன்	8	தகவல்கள் சிறப்பாக ஒழுங்கமைக்கப்பட்டு, தெளிவாகவும் சுவாரஸ்யமாகவும் பொருத்தமான ஆதாரங்களுடன் வழங்கப்படுகின்றன.	தகவல்கள் ஒழுங்கமைக்கப்பட்டு பெரும்பாலும் தெளிவாக வழங்கப்படுகின்றன.	தகவல்கள் புரிந்து கொள்ளக்கூடியதாக இருந்தாலும்க தெளிவு மற்றும் ஒழுங்கமைப்பு குறைவாக உள்ளது.
5.	தொடர்புத்திறன்	8	கருத்துகள் தெளிவாகவும், தன்னம்பிக்கையுடனும், ஈர்க்கக் கூடியவகையிலும், பொருத்தமான ஆதாரங்களுடன் வெளிப்படுத்தப்படுகின்றன.	கருத்துகள் தெளிவாகவும், மிதமான தன்னம்பிக்கையுடனும், போதுமான ஆதாரங்களுடனும் வெளிப்படுத்தப்படுகின்றன.	கருத்துப்பரிமாற்றம் புரிந்துகொள்ளக்கூடியதாக இருந்தாலும்க தெளிவு, தன்னம்பிக்கை அல்லது பொருத்தமான ஆதாரங்களின் குறைபாடுகாணப்படுகிறது.
	மொத்தம்	40			

CO6-க்கான மதிப்பீட்டு அளவு கோல்கள்

வரி சை எண்	மதிப்பீட்டு அளவுகோல்	மதிப் பெண் கள்	மிகச்சிறப்பு (7-8)	சிறப்பு (4-6)	திருப்திகரம் (1-3)
1.	அறிவின் பயன்பாடு	8	தமிழர்களின் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டுக்கருத்து க்களை செயல் வழிப்பணிகள் மற்றும் திட்டங்களில் திறம்படப்பயன்படு த்துகிறார்.	கருத்துக்களை சிறிய வழிகாட்டுதலு டன் சரியாகப் பயன்படுத்துகி றார்.	கருத்துக்களை அடிப்படை அளவில் மட்டுமே பயன்படுத்துகிறார்.
2.	திட்டப்பணி செயல்படுத்த ல்	8	திட்டப்பணி முழுமையானதாக வும், புதுமையானதாகவு ம், சிறந்த திட்டமிடலுடன்வெ ற்றிகரமாக நிறைவேற்றப்பட்ட தாகவும் உள்ளது.	திட்டப்பணி சிறிய குறைபாடுக ளுடன் நன்கு செயல்படுத் தப்பட்டுள்ள து.	திட்டப்பணி குறைந்தபட்ச தேவைகளைப் பூர்த்தி செய்கிறது; ஆனால் ஆழமும் முழுமையும் குறைவாக உள்ளன.
3.	ஆதாரங்கள் மற்றும் வளங்களின் பயன்பாடு	8	திட்டத்தின் முடிவுகளை ஆதரிக்க பொருத்தமான தரவுகள், ஆதாரங்கள் மற்றும் எடுத்துக்காட்டுக ளை திறம்படப் பயன்படுத்துகிறார்.	போதுமான ஆதாரங்களுட ன் பொருத்தமான வளங்களைப் பயன்படுத்துகி றார்.	குறைந்த அளவிலான ஆதாரங்கள் மற்றும் வளங்களைப் பயன்படுத்துகிறார்.
4.	வழங்கல் மற்றும்ஆவ ணப்படுத்தல்	8	முடிவுகளைத் தெளிவாகவும் தொழில்முறைமு றையிலும் சிறப்பான ஆவணப்படுத்தலுட ன் வழங்குகிறார்.	நல்ல ஆவணப்படுத்த லுடன் தெளிவாக வழங்குகிறார்.	வழங்கல் மற்றும் ஆவணப்படுத்தல் போதுமானதாக இருந்தாலும் தெளிவும் விவரங்களும் குறைவாக உள்ளன.

5.	ஆவணப்படுத்தலின்தரம்	8	ஆவணப்படுத்தல் முழுமையானதாகவும், துல்லியமானதாகவும், நன்கு ஒழுங்கமைக்கப்பட்டதாகவும், சரியான வடிவமைப்புடன் அமைந்ததாகவும் உள்ளது.	ஆவணப்படுத்தல் முழுமையாகவும், சிறிய விடுபாடுகளுடன் ஒழுங்கமைக்கப்பட்டதாகவும் உள்ளது.	ஆவணப்படுத்தல் போதுமானதாக இருந்தாலும், விவரம், துல்லியம் அல்லது சரியான ஒழுங்கமைப்பு ஆகியவற்றில் குறைபாடுகள் காணப்படுகின்றன.
	மொத்தம்	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26HMC01	HERITAGE OF TAMILS B.E. (Common to all Branches)		SEMESTER			I		
Prerequisites			Category	HM	Credits		1	
Basics of Tamil Language and Literature.			Hours/ Semester	L	T	P	SL	TH
				15	0	0	15	30
COURSE OBJECTIVES								
1.	To obtain the knowledge of Tamil Language and Literature.							
2.	To familiarize with painting and Sculpture.							
3.	To know about the folks and martial arts.							
4.	To understand the Thinaï concept of Tamils.							
5.	To know about the contribution of Tamils to Indian National Movement and Indian Culture.							
UNIT - I		LANGUAGE AND LITERATURE						3
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.								
UNIT - II		HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE						3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.								
UNIT - III		FOLK AND MARTIAL ARTS						3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.								
UNIT - IV		THINAI CONCEPT OF TAMILS						3
Lora and Fauna of Tamils, Aham and Puram Concepts from Tholkappiyam and Sangam Literature-Aram Concept of Tamils, Education and Literacy during the Sangam Age. Ancient Cities and Ports of the Sangam Age, Export and Import during the Sangam Age Overseas Conquests of the Cholas.								
UNIT - V		CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE						3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.								
L:15, SL:15, Total:30 Hours								

Weightage:

Continuous Assessment: 40%

End Semester Examinations: 60%

REFERENCE BOOKS:

1.	Dr. K. K. Pillay., "Social Life of Tamils" A joint publication of TNTB & ESC and RMRL – (in print)
2.	Dr. S. Singaravelu., "Social Life of the Tamils - The Classical Period", International Institute of Tamil Studies Publications.
3.	"Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Publications, Tamil Nadu.
4.	"Keeladi-Sangam City Civilization on the banks of river Vaigai", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Publications, Tamil Nadu.
5.	"Heritage of Tamils", Muthuramalingam S and Dr Saravanakumar. M, Yes Dee Publication, 2023.

E-RESOURCES:

1.	https://en.wikipedia.org/wiki/Dravidian_languages
2.	https://www.tamilvu.org/courses/degree/
3.	https://www.scribd.com/document/802136891/Heritage-of-Tamils
4.	https://www.scribd.com/document/718189396/AKAM-AND-PURAM
5.	https://pmc.ncbi.nlm.nih.gov/articles/PMC10357311/

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

CO1	Acquire knowledge of Tamil language, literature and the Thinaï concepts that reflect the cultural and ecological wisdom of the Tamils.	PO9	-
CO2	Familiarize with the artistic heritage of the Tamils through the study of painting, sculpture, folk traditions and martial arts.	PO9	-
CO3	Understand the contributions of Tamils to Indian culture, society and the national movement.	PO9	PSO1
CO4	Develop an appreciation of Tamil civilization, its cultural practices, artistic achievements, and enduring values in shaping Indian heritage.	PO9	-
CO5	Examine the traditional scientific knowledge, technological achievements, and cultural heritage of the Tamils and understand their historical and contemporary significance.	PO9, PO11	PSO3
CO6	Demonstrate the applications and relevance of Tamil scientific, technological and cultural contributions through practical activities, case studies and project-based work.	PO9, PO11	PSO3

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01									3					
C02									3					
C03									3			2		
C04									3					
C05									3		2			2
C06									3		2			2

Activities:

1.	C05: Examine the traditional scientific knowledge, technological achievements, and cultural heritage of the Tamils, and understand their historical and contemporary significance. Seminar Presentation on ancient Tamil scientific and technological achievements (e.g., irrigation systems, architecture, metallurgy, maritime trade). Group Discussion on the relevance of traditional Tamil knowledge systems in modern society. Case Study Analysis of Tamil cultural heritage sites, monuments, and engineering marvels. Heritage Exhibition displaying charts, models, and photographs related to Tamil cultural and technological contributions, Quiz and Debate on Tamil literary, scientific, and cultural achievements. Field Visit to museums, heritage sites, temples or archaeological locations and submission of a report.
2.	C06: Demonstrate the applications and relevance of Tamil scientific, technological, and cultural contributions through practical activities, case studies, and project-based work. Mini Project on traditional Tamil technologies such as water management, agricultural practices, or indigenous architecture. Model Making Activity depicting Tamil engineering achievements (e.g., Kallanai Dam, temple architecture, ancient ships). Case Study Presentation comparing ancient Tamil technologies with contemporary technologies. Practical Demonstration of traditional arts, crafts, folk practices, or indigenous techniques. Community-Based Project documenting local traditional knowledge, folk practices, or cultural heritage and presenting the findings, Digital Portfolio Development showcasing project outcomes, photographs, reports, and reflections on Tamil heritage and technology.

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (7-8)	Good(4-6)	Satisfactory (1-3)
1.	Knowledge of Tamil Heritage	8	Demonstrates comprehensive understanding of Tamil scientific, technological, and cultural heritage with accurate details.	Demonstrates good understanding with minor omissions.	Demonstrates basic understanding with limited details

2.	Historical Understanding	8	Clearly explains historical context and significance with relevant examples.	Explains historical context with some supporting examples.	Provides limited explanation of historical context.
3.	Contemporary Relevance	8	Effectively relates traditional knowledge and achievements to present-day applications and issues.	Relates traditional knowledge to modern applications with some clarity.	Identifies a few modern connections.
4.	Presentation Skills	8	Content is well-organized, visually appealing, and presented effectively.	Content is organized and presented clearly	Content is organized and presented clearly with minor shortcomings.
5.	Communication Skills	8	Ideas are communicated clearly, confidently, and engagingly with appropriate supporting evidence.	Ideas are communicated clearly with moderate confidence and adequate support.	Communication is understandable but lacks clarity, confidence, or supporting evidence.
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Application of Knowledge	8	Effectively applies Tamil scientific, technological, and cultural concepts to practical tasks and projects.	Applies concepts correctly with minor guidance.	Applies concepts at a basic level with limited effectiveness.
2.	Project Execution	8	Project is comprehensive, innovative, well-planned, and successfully completed.	Project is well-executed with minor shortcomings.	Project meets minimum requirements but lacks depth or completeness.
3.	Use of Evidence and Resources	8	Effectively uses relevant data, sources, and examples to support project outcomes.	Uses appropriate resources with adequate supporting evidence.	Uses limited resources and supporting evidence.
4.	Presentation Skills	8	Presents findings clearly, professionally, and effectively.	Presents findings clearly with minor shortcomings.	Presentation is adequate but lacks clarity, organization or professionalism.

5.	Documentation Quality	8	Documentation is comprehensive, accurate, well-organized and properly formatted.	Documentation is complete and organized with minor omissions.	Documentation is adequate but lacks detail, accuracy, or proper organization.
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage $\geq 20\%$);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage $<10\%$);

26MEC02	ENGINEERING PRACTICES LABORATORY			SEMESTER			I	
Prerequisites			Category	SD	Credits			2
Fundamental understanding of measurement tools and safety procedures			Hours/ Semester	L	T	P	SL	TH
				0	0	45	15	60
COURSE OBJECTIVES								
1.	To provide hands-on exposure in basic manufacturing and fabrication practices.							
2.	To develop practical skills in carpentry, fitting, plumbing and sheet metal operations.							
3.	To train students in machining, welding and foundry practices.							
4.	To develop problem solving, safety awareness and teamwork skills through laboratory activities.							
LIST OF EXPERIMENTS								
1.	SAFETY & WORKSHOP PRACTICES Study of workshop safety measures, PPE and first aid practices. Demonstration of workshop tools, measuring instruments and machine shop practices.							4
2.	FITTING AND CARPENTRY PRACTICES Preparation of Half-Lap / T-Joint / Dovetail Joint using carpentry tools and wooden workpieces Preparation of V-fitting Square and Curve fitting using mild steel specimen.							14
3.	SHEET METAL AND PLUMBING PRACTICES Preparation of Square Tray / Cylinder / Conical Funnel using GI sheet. Preparation of Single Seam and Double Seam joints. Preparation of PVC pipe connections and saddle connection.							14
4.	FOUNDRY AND WELDING PRACTICES Green sand preparation and mould cavity preparation using foundry tools. (Single and Split Patterns) Demonstration and practice of Arc welding of Butt, Lap and T-joints.							14
5.	MACHINING PRACTICES Lathe operations – Facing, Turning, Chamfering, Knurling and Taper turning. Drilling and Tapping operations on mild steel specimen.							14
P:45, SL:15, Total:60 Hours								
Weightage: Continuous Assessment 60% End Semester Examinations 40%								
REFERENCE BOOKS:								
1.	Bawa, H.S, "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.							
2.	Jeyachandran.K, Natarajan.K and Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.							
3.	Jeyapoovan.T, SaravanaPandian.M, and Pranitha.S, "Engineering Practices Lab Manual", Vikas Publishing House Pvt. Ltd, 2006.							
4.	Dr. P.Kannan, Mr. T.Satheeskumar & Mr.K.Rajasekar, "Engineering practices laboratory" Manual first edition 2017.							
5.	Dr. V. Rameshbabu "Engineering practices laboratory" VRB publication pvt Id.							

E-RESOURCES:

1. [Virtual Labs - NPTEL Labs for Mechanical Engineering](#)

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

CO1	Explain safety procedures, workshop tools and engineering practices used in manufacturing environments.	PO1, 2, 5, 6, 7, 8, 10	PSO1
CO2	Construct wooden and metal fitting joints using appropriate carpentry and fitting tools.	PO1, 2, 3, 5, 9	PSO1, PSO2
CO3	Fabricate sheet metal and plumbing components using suitable tools and techniques.	PO1, 2, 3, 5, 9	PSO1, PSO2
CO4	Perform welding and foundry operations to manufacture engineering components.	PO1, 2, 3, 4, 5, 9	PSO1, PSO2
CO5	Perform various machining operations in mild steel rod by operating lathe and drilling machines	PO1, 2, 3, 4, 5, 8, 9, 10, 11	PSO1, 2, 3
CO6	Develop a model product using practical engineering skills, teamwork and problem-solving ability through workshop practices and self-learning activities.	PO1, 2, 3, 4, 5, 8, 9, 10, 11	PSO1, 2, 3

The Course Articulation Matrix (CAM) for defined COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO01	PSO02	PSO03
CO1	3	2	-	-	1	2	2	3		1	-	1	-	-
CO2	3	3	2	-	2	--	-	-	2	-	-	3	2	-
CO3	3	3	3	-	2	-	-	-	2	-	-	3	2	-
CO4	3	3	3	2	2	-	-	-	2	-	-	3	3	-
CO5	3	2	2	1	3	2	1	-	1	-	-	2	3	1
CO6	2	3	2	1	1	-		2	3	3	2	2	2	3

Activities:

1. Design and Fabrication of a Multi-Utility Tool Stand
2. Design and Fabrication of a Portable Study Lamp with Storage Box

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Safety Practices & Discipline	20	Consistently follows all safety procedures independently	Uses tools accurately and independently with high proficiency	Follows safety procedures inconsistently
2.	Tool Handling & Technical Skills	20	Uses tools accurately and independently with high proficiency	Uses tools correctly with occasional support	Uses tools with frequent assistance

3.	Execution of Practical Work	25	Produces accurate work meeting specifications with excellent finish	Produces acceptable work with minor errors	Produces work with noticeable errors requiring correction
4.	Problem Solving & Application Skills	15	Identifies and solves problems independently with innovative approach	Identifies and solves problems independently with innovative approach	Requires continuous support for solving problems
5.	Teamwork & Participation	10	Actively contributes and works effectively in teams	Participates adequately in team activities	Limited participation in teamwork
6.	Documentation & Self-Learning	10	Well-maintained records with additional learning inputs	Records maintained with minor omissions	Incomplete records with limited learning evidence
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Laboratory Component		Percentage allocation	Mapping Strength
	Evaluation of Student Work, Observation of Record and Model Test	Activities		
CO1	20		10	2
CO2	20		10	2
CO3	20		10	2
CO4	20		10	2
CO5	20		10	2
CO6		100	50	2
Total	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26MAC02	ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES B.E. (Common to CIVIL, ECE, MECH & METT)				SEMESTER			II		
Prerequisites					Category	BS	Credits			4
Basic knowledge of calculus, differential equations, complex numbers and elementary integration techniques.					Hours/ Semester	L	T	P	SL	TH
						45	15	0	60	120
COURSE OBJECTIVES										
1.	To understand the theory and solution methods of ordinary differential equations, including higher order equations, Euler–Cauchy equations, Legendre’s equations and systems of simultaneous differential equations.									
2.	To develop proficiency in Laplace transform techniques and their applications in solving initial value problems arising in science and engineering.									
3.	To acquire knowledge of Fourier series representations, harmonic analysis and Parseval’s identity for analyzing periodic functions.									
4.	To understand Fourier, transform methods, their properties and applications in solving problems related to signal analysis and integral transforms.									
5.	To learn the concepts of Z-transforms and difference equations and apply transform techniques for solving discrete mathematical and engineering models.									
UNIT - I		ORDINARY DIFFERENTIAL EQUATIONS								9+3
Homogeneous linear ordinary differential equations of second order -general solution- Particular Integral-Solution by variation of parameters-Homogeneous equations of Euler–Cauchy and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.										
UNIT - II		LAPLACE TRANSFORMS								9+3
Existence theorem - Transform of standard functions – Transform of Unit step function and Dirac delta function – Basic properties - Shifting theorems - Transforms of derivatives and integrals – Transform of periodic functions - Initial and Final value theorem - Inverse Laplace transforms- Convolution theorem (without proof) – Solving Initial value problems by using Laplace Transform techniques.										
UNIT - III		FOURIER SERIES								9+3
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Parseval’s identity – Computation of harmonics.										
UNIT - IV		FOURIER TRANSFORMS								9+3
Fourier integral theorem – Fourier transform pair - Fourier sine and cosine transform – Properties – Transform of elementary functions – Inverse Fourier Transforms - Convolution theorem (without proof) – Parseval’s identity.										
UNIT - V		Z – TRANSFORM AND DIFFERENCE EQUATIONS								9+3
Z-transform – Properties of Z-transform – Inverse Z-transform – Convolution theorem – Evaluation of Inverse Z transform using partial fraction method and convolution theorem - Initial and final value theorems – Formation of difference equations – Solution of difference equations using Z - transform.										
L:45, T:15, SL:60, Total:120 Hours										
Weightage:										
Continuous Assessment: 40%										
End Semester Examinations: 60%										

TEXT BOOKS:

1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45 th Edition, New Delhi, 2020.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", 10 th Edition, Wiley India Pvt Ltd., New Delhi, 2018.

REFERENCE BOOKS:

1.	N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008
2.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5 th Edition, New Delhi, 2017.
3.	Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7 th Edition, New Delhi, 2012.

E-RESOURCES:

1.	NPTEL, "Differential Equations", National Programme on Technology Enhanced Learning, https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ma115
2.	NPTEL, "Transforms and Their Applications", National Programme on Technology Enhanced Learning, https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ma56
3.	MIT OpenCourseWare, "Differential Equations", Massachusetts Institute of Technology, https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/
4.	Paul's Online Math Notes, "Differential Equations", Lamar University, https://tutorial.math.lamar.edu/classes/de/de.aspx
5.	Wolfram MathWorld, "Fourier Series, Fourier Transform, Laplace Transform and Z-Transform", Wolfram Research, https://mathworld.wolfram.com/LaplaceTransform.html

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

CO1	Remember and understand the fundamental concepts and methods of ordinary differential equations, Laplace transforms, Fourier series, Fourier transforms, and Z-transforms including solutions of differential equations, transform techniques, Fourier expansions, transform properties, convolution theorems and difference equations used in mathematical and engineering applications.	--	--
CO2	Apply the techniques of ordinary differential equations, Laplace transforms, Fourier series, Fourier transforms and Z-transforms to solve mathematical and engineering problems involving initial value problems, periodic functions, signal analysis, transform methods and difference equations.	PO1	PSO1
CO3	Analyze mathematical and engineering problems using ordinary differential equations, Laplace transforms, Fourier series, Fourier transforms, and Z-transforms by selecting appropriate analytical methods, interpreting transform-domain representations, examining periodic behaviours and solving continuous and discrete system models.	PO2	PSO1
CO4	Investigate and interpret mathematical models through assignments, case-based problems and transform techniques to develop logical reasoning and problem-solving skills for engineering applications.	PO3	PSO2

C05	Solve assignment-based analytical problems involving differential equations, Laplace transforms, Fourier series, Fourier transforms and Z-transforms by applying systematic mathematical procedures and computational techniques.	PO5	PSO2
C06	Communicate mathematical concepts, transform techniques, solution procedures and results effectively through proper mathematical notation, graphical representation, computational output, assignments and structured report writing for engineering and applied science problems.	PO10	--

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01														
C02	3											3		
C03		2										2		
C04			1										1	
C05					3								1	
C06										3				
Avg	3	2	1		3					3		2.5	1	

Activities:

1.	Students shall solve selected problems from ordinary differential equations, Laplace transforms, Fourier series, Fourier transforms, Z-transforms and difference equations using systematic analytical methods and suitable computational tools such as Python, GeoGebra or open-source software. This activity develops the ability to apply transform techniques and computational methods to solve engineering and applied science problems with accuracy and logical reasoning.
2.	Students shall prepare a structured assignment report or presentation on selected application-oriented problems involving ordinary differential equations, Laplace transforms, Fourier series, Fourier transforms, Z-transforms and difference equations. The activity may include problem formulation, step-by-step solution, graphical representation, computational output, interpretation of results, and conclusion. This activity develops the ability to communicate mathematical concepts, transform techniques, solution procedures and results effectively using proper notation, graphs and organized report writing.

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Selection and understanding of problem	8	Suitable analytical problem is selected and the concept is clearly understood	Problem is selected properly, but conceptual explanation needs minor improvement	Problem selection is basic and conceptual understanding is limited

2.	Application of mathematical method	8	Correct method is applied with clear step-by-step solution	Method is mostly correct with minor errors	Method is unclear or contains major errors
3.	Use of analytical/computational technique	8	Analytical or computational technique is used effectively and results are accurate	Technique is used properly, but minor computational/procedural errors are present	Technique usage is incomplete or not clearly demonstrated
4.	Accuracy and interpretation of results	8	Results are accurate and clearly interpreted with engineering/application relevance	Results are mostly correct, but interpretation needs improvement	Results are inaccurate or interpretation is weak
5.	Presentation and professional communication	8	Work is professionally presented with clear mathematical communication	Presentation is good with minor organizational issues	Presentation is satisfactory but lacks consistency
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Clarity of mathematical explanation	8	Concepts, formulae and solution procedures are explained clearly and correctly	Explanation is understandable, but needs minor improvement	Explanation is incomplete or unclear
2.	Use of mathematical notation, graphs and representation	8	Proper notation, equations, graphs, tables or computational outputs are used effectively	Notation and representation are mostly correct with minor errors	Notation is poor or graphical/computational representation is missing
3.	Organization of assignment/report/presentation	8	Report/presentation is well structured with problem statement, method, solution, result, interpretation and conclusion	Report/presentation is organized, but some sections need improvement	Report/presentation is poorly organized or incomplete
4.	Interpretation and communication of results	8	Results are interpreted clearly and communicated effectively with logical conclusion	Results are communicated properly, but interpretation is limited	Interpretation and communication of results are weak
5.	Overall presentation and academic quality	8	Work demonstrates excellent academic quality and professional presentation	Academic quality is good with minor issues	Academic presentation is satisfactory
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	12	2
CO2	24	24	-	-	24	3
CO3	16	16	-	-	16	2
CO4	8	8	-	-	8	1
CO5	-	-	40	-	25	3
CO6	-	-	-	40	25	3
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26ENC02	PROFESSIONAL ENGLISH B.E. (Common to all Branches)		SEMESTER				II
Prerequisites		Category	HM	Credits			2
Basic language skills listening, speaking, reading and writing		Hours/ Semester	L	T	P	SL	TH
			30	-	15	15	60
COURSE OBJECTIVES							
1.	To develop learners’ overall communication competence through integrated listening, reading, speaking, and writing activities.						
2.	To enhance learners’ reading fluency and comprehension with appropriate pronunciation, intonation, and expression across different text types.						
3.	To build learners’ oral communication skills for narration, speeches, presentations, and professional interactions.						
4.	To equip learners with organizational and presentation skills required for academic, technical, and event-based communication.						
5.	To enable learners to describe processes, ideas, and technical activities clearly and confidently in real-life contexts.						
UNIT - I		FUNDAMENTALS OF COMMUNICATION					9
Listening: Interview with personal assistant, An interview with a business consultant, Describing changes in a company. Reading: Reading a short story – learning pronunciation, intonation, splitting of sentences to form meaningful units. Speaking: Self-introduction, name, home background, study details, area of interest, hobbies, strengths and weaknesses, etc. Writing: Communication and its types - Technical Communication, Review of a favourite movie or a book. Grammar: Tenses – Present tense, Past tense, Future tense. Voices – Active voice, Passive voice.							
UNIT - II		PRESENTATION SKILLS					9
Listening: An interview about a production process, Telephone conversations, Making and changing appointments. Reading: Reading a poem – learning the skill of reciting, appreciate rhyme and music, change in tone etc. Speaking: Power point presentation on a general topic. Writing: Essay writing – Descriptive and narrative essays, Precise writing. Grammar: Common errors in English – Subject Verb agreement, Articles.							
UNIT - III		PUBLIC SPEAKING					9
Listening: Conversation between two employees, Interview about change in job and corporate gift giving. Reading: Reading newspaper article – learning vocabulary and language pattern of official communication. Speaking: Oral presentation on a topic from basic engineering related to their branch. Writing: Writing a news article, Minutes of meetings. Grammar: Prefix and suffix, Phrasal verbs, Degrees of comparison.							
UNIT - IV		ORGANIZING EVENTS					9
Listening: Working in an international team, Statistical information, Interview with investor relations. Reading: Company profiles, Statement of Purpose (SOP), An excerpt of interview with professionals. Speaking: Proposing welcome address, vote of thanks and organizing events. Writing: Letter Writing – Formal Letters and Informal Letters, Job Application, Cover letter with resume. Grammar: Reported speech, Question tags, Simple, Compound and Complex sentences.							

UNIT - V	PROCESS DESCRIPTION	9	
Listening: An interview with recruitment agent, Meeting extracts, Description of how a product is advertised. Reading: Reading advertisements, gadget reviews, user manuals. Speaking: Describing a process – taking print outs, purchasing equipment for a company, booking a hall for meeting etc. Writing: Process description, Designing advertisements. Grammar: Cloze test, Homophones, Cause and effect expressions.			
L:30, P:15, SL:15, Total:60 Hours			
Weightage: Continuous Assessment - 50% End Semester Examinations - 50%			
REFERENCE BOOKS:			
1.	Beare, Kenneth. <i>Reading Skills Success in 20 Minutes a Day</i> . 4th ed., Learning Express, 2017.		
2.	Hewings, Martin. <i>Advanced English Grammar</i> . 3rd ed., Cambridge University Press, 2019.		
3.	Koneru, Aruna. <i>English Language Skills for Engineers</i> . McGraw Hill Education, 2020.		
4.	Murphy, Raymond. <i>English Grammar in Use</i> . 5th ed., Cambridge University Press, 2019.		
5.	Guffey, Mary Ellen, and Dana Loewy. <i>Essentials of Business Communication</i> . 12th ed., Cengage Learning, 2021		
E-RESOURCES:			
1.	https://learnenglish.britishcouncil.org/		
2.	https://www.futurelearn.com/		
3.	https://www.ted.com/		
4.	https://www.cambridgeenglish.org/		
5.	https://www.coursera.org/		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Demonstrate effective listening, reading, speaking, and writing (LSRW) skills in academic and professional communication contexts.	PO9, PO11	
CO2	Apply appropriate grammar, vocabulary, pronunciation, and language conventions to ensure accurate, fluent, and effective communication across various contexts.	PO9, PO11	
CO3	Deliver oral presentations, speeches, and self-introductions confidently using suitable verbal and non-verbal communication strategies.	PO9, PO11	PSO1
CO4	Analyze and interpret different forms of written texts such as stories, poems, newspaper articles, company profiles, advertisements, and technical documents.	PO9, PO11	PSO2
CO5	Develop professional writing skills for drafting reviews, essays, news articles, minutes of meetings, letters, resumes, cover letters, process descriptions, and advertisements.	PO9, PO10	PSO3
CO6	Organize and participate effectively in workplace and social communication activities by demonstrating presentation, event management, interpersonal, and professional communication skills.	PO8, PO9, PO11	PSO3

The Course Articulation Matrix (CAM) for defined COs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	PSO 1	PSO 2	PSO 3
CO1									3		2			
CO2									3		2			
CO3									3		2	1		
CO4									3		2		1	
CO5									3	2				2
CO6								2	3		2			2

Activities:

1.	CO5: Develop professional writing skills for drafting reviews, essays, news articles, minutes of meetings, letters, resumes, cover letters, process descriptions, and advertisements. (i) Review Writing Activity: Write a critical review of a favorite book, movie, gadget, or product by analyzing its features, strengths, weaknesses, and overall impact on the audience. (ii) News Article and Meeting Minutes Preparation: Attend a mock event, seminar, club activity, or classroom discussion and prepare a news article and formal minutes of the meeting following standard format. (iii) Professional Correspondence Portfolio: Prepare a portfolio consisting of formal letters, informal letters, job application letters, resumes, and cover letters for different academic and professional scenarios. (iv) Process Description: Develop a step-by-step process description for technical and administrative activities such as online registration, booking a meeting hall, purchasing equipment, printing documents, or conducting an event. (v) Advertisement and Creative Writing Project: Design print or digital advertisements for products, services, technical events, or social awareness campaigns highlighting their purpose and target audience.
2.	CO6: Organize and participate effectively in workplace and social communication activities by demonstrating presentation, event management, interpersonal, and professional communication skills. (i) Professional Presentation Activity: Prepare and deliver an individual or group PowerPoint presentation on a technical, social, or current-affairs topic, demonstrating effective verbal and non-verbal communication skills. (ii) Organizing Events: Plan and organize a mock academic or professional event by assigning roles, preparing schedules, coordinating tasks, and delivering welcome addresses and vote of thanks. (iii) Workplace Communication Role Play: Participate in role-play activities involving interviews, telephone conversations, appointment scheduling, team discussions, client interactions, and workplace problem-solving situations.

	(iv) Public Speaking and Group Discussion Activity: Engage in extempore speeches, group discussions, debates, and seminar presentations on engineering, social, or professional topics to improve confidence and interpersonal communication. (v) Professional Interaction and Team Collaboration Project: Work collaboratively in teams to conduct meetings, coordinate event-related tasks, prepare communication plans, and demonstrate leadership, teamwork, and professional etiquette in achieving common objectives.
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Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Content Relevance and Completeness	10	Content is highly relevant, complete, and fully meets task requirements	Mostly relevant and complete with minor omissions	Adequate content but lacks depth or some key points missing
2.	Organization and Format	10	Excellent adherence to format	Proper format with minor structural issues	Basic structure present but inconsistent formatting
3.	Clarity and Coherence	10	Ideas are very clear, logically sequenced, and easy to follow	Generally clear with minor lapses in flow	Understandable but lacks smooth transitions
4.	Language Use	10	Excellent grammar, precise vocabulary, no errors	Minor grammatical / spelling errors	Noticeable errors but meaning is clear
	Total	40			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Presentation Skills	10	Highly confident, clear articulation, excellent eye contact, and engaging delivery	Clear and confident with minor issues in delivery	Adequate presentation with some hesitation
2.	Communication Effectiveness	10	Excellent verbal & non-verbal communication; ideas conveyed clearly and persuasively	Good communication with minor gaps	Understandable communication but lacks impact
3.	Interpersonal Skills and Teamwork	10	Excellent collaboration, leadership, and positive interaction with team members	Good teamwork and cooperative behavior	Works with team but limited engagement
4.	Event/Activity Organization Skills	10	Excellent planning, coordination, and execution of tasks/events	Good organization with minor gaps in execution	Basic organization with limited efficiency
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Theory Component				Laboratory Component		Percentage allocation	Mapping Strength
	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
CO1	12	12			10	10	11	2
CO2	24	24			20	20	22	3
CO3	12	12			30	30	21	3
CO4	12	12			20	20	16	2
CO5			40		10	10	15	2
CO6				40	10	10	15	2
Total	60	60	40	40	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26PHC02	MATERIALS SCIENCE		SEMESTER				II
Prerequisites		Category	BS	Credits			3
		Hours/ Semester	L	T	P	SL	TH
			45	0	0	45	90
COURSE OBJECTIVES							
1.	To understand the fundamental concepts of semiconductor materials, carrier transport mechanisms, and their applications.						
2.	To explain the polarization mechanisms, dielectric behaviour and practical applications of dielectric materials in electrical and electronic systems.						
3.	To analyse the properties and applications of magnetic materials and superconductors used in modern engineering technologies.						
4.	To gain knowledge of nanomaterials, their synthesis techniques, characterization methods, properties and multidisciplinary applications.						
5.	To understand advanced engineering materials such as metallic glasses, shape memory alloys, ceramics, composites and their applications.						
UNIT - I	SEMICONDUCTING MATERIALS						9
Semiconductor materials: Intrinsic and extrinsic semiconductors - Carrier concentration(derivation) for intrinsic semiconductor, n-type and p-type semiconductor – Fermi level – Variation of carrier concentration on temperature and impurity – Direct and indirect bandgap semiconductor – Drift and diffusion currents – Hall effect – Determination of Hall coefficient – Applications – Metal–semiconductor junctions (Ohmic and Schottky junctions). Activity: Virtual demonstration of Hall effect							
UNIT - II	DIELECTRIC MATERIALS						9
Dielectric materials: Dielectric polarization – Electronic, ionic, orientational and space charge polarization – Internal fields in solids – Clausius–Mossotti relation – Frequency dependence of polarization - Application of dielectric materials (transformers and capacitors), Dielectric loss – Dielectric breakdown - Ferro and piezo electric materials. Activity: Virtual demonstration of ferro electric materials							
UNIT - III	MAGNETIC AND SUPERCONDUCTING MATERIALS						9
Magnetic Materials: Magnetic material parameters, Ferromagnetic materials – Hysteresis - Ferrites – Soft and Hard magnetic materials, GMR sensors, magnetic disk memories, Principle of magnetic recording, Materials for magnetic data storage. Superconductivity: Properties – Type I & Type II superconductors – BCS theory – Applications – magnetic levitation – SQUID. Activity: Virtual demonstration of MAGLEV trains							
UNIT - IV	NANOMATERIALS						9
Nanomaterials: Introduction – Classification of nanomaterials – Top-down and bottom-up approaches – Synthesis techniques: Ball milling, Plasma arcing, Sol-Gel method – Quantum confinement effect – Quantum structures: Quantum wells, Quantum wires and Quantum dots –Band gap of nanomaterials. Carbon nanotubes – Graphene, Fullerene and Buckyballs – Structure – Properties – Applications. Nanodevices: Quantum dot LEDs (QLEDs), Nanosensors and Nano-transistors Activity: Virtual demonstration of QLED							

UNIT - V		ADVANCED ENGINEERING MATERIALS		9
Metallic Glasses: Preparation – Properties – Applications. Shape Memory Alloys (SMA): Types – Properties – Applications. Ceramic Materials: Classification – Properties – Traditional and advanced ceramics – Applications. Composite Materials: Classification – Fibre reinforced composites – Particle reinforced composites – Properties – Applications.				
Activity: Virtual demonstration of melt-spinning process				
L:45, SL:45, Total: 90 Hours				
Weightage: Continuous Assessment 40% End Semester Examinations 60%				
TEXT BOOKS:				
1.	M. Arumugam, 'Materials Science', Anuradha Publications, Kumbakonam, 2018.			
2.	V. Rajendran and A. Marikani, 'Materials Science', Tata McGraw Publications, New Delhi, 2012.			
3.	S.O. Pillai, 'Solid State Physics', New Age International Publishers, New Delhi, 2026.			
REFERENCE BOOKS:				
1.	Charles Kittel, 'Introduction to Solid state Physics', John Wiley and Sons, 7 th Edition, Singapore, 2019.			
2.	Charles P. Poole and Frank J. Owens, 'Introduction to Nanotechnology', Wiley India, 2007.			
3.	S. O. Kasap, 'Principles of electronic materials and devices', McGrawHill Education, 2007.			
E-RESOURCES:				
1.	Hall Effect: https://ssp-amrt.vlabs.ac.in/exp/hall-effect-chargecarrier/simulation.html			
2.	Hysteresis curve: https://em-amrt.vlabs.ac.in/exp/quinckes-method			
3.	Magnets and Electromagnets: https://phet.colorado.edu/en/simulations/magnets-and-electromagnets			
COURSE OUTCOMES (COs) At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Explain the preparation, properties and applications of various materials.		--	
CO2	Apply the principles of various materials to identify suitable materials for diverse applications.		PO1	
CO3	Analyse the properties and performance of different materials suitable for specific applications.		PO2	
CO4	Perform experimentations as a group and interpret the results.		PO4, PO8	
CO5	Communicate the societal, environmental and technological impacts of engineering materials in solving real-world problems.		PO6, PO9	PSO3
CO6	Analyse emerging engineering materials to address modern industrial and societal needs in engineering applications through self-learning activities.		PO11	

The Course Articulation Matrix (CAM) for defined COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2	3													
CO3		3												
CO4				2				2						
CO5						2			2					2
CO6											2			

Activities:

1.	a. Experimental determination of Hall coefficient / Hysteresis loop for a ferromagnetic material (CO4) b. Seminar / Poster presentation on dielectric materials in renewable energy systems / Economic, Environmental and Social issues of material usage (CO5)
2.	a. Literature review on nanomaterial product for real-world problems (CO6) b. Seminar/Poster presentation on emerging concepts and advancements in materials science, considering the economic, environmental, and societal impacts of material usage. (CO5)

Rubrics for evaluation: CO4

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Formula / Theory	5	Clearly explains the concept with correct formula	Explains the concept with minor errors	Limited understanding of theory and formula
2.	Procedure & Observation	5	Clearly performs and explains the experimental procedure with accurate observations	Performs the procedure with minor mistakes	Procedure and observations are poorly explained
3.	Result & Interpretation	10	Correctly calculates and correlates the result with theoretical concepts	Result is obtained with partial interpretation	Incorrect or incomplete result interpretation
	Total	20			

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Subject Knowledge	5	Clearly explains the concept with relevant examples	Good explanation with minor gaps	Basic understanding of the topic
2.	Content Organization	5	Information is well-organized, clear, and logically presented	Organization is good with minor improvements needed	Average organization of content

3.	Poster / Presentation Design	5	Attractive, creative, and easy-to-understand design with effective visuals	Good design with minor issues	Adequate design with limited visuals
4.	Communication Skills	5	Confident presentation with clear explanation and effective response to questions	Good communication with slight hesitation	Basic communication skills
	Total	20			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Topic Understanding	5	Clearly explains the concept and its real-world application with relevant details	Good explanation with minor gaps	Basic understanding of the topic
2.	Literature Review	5	Reviews and compares multiple relevant research articles effectively	Reviews relevant articles with some comparison	Limited review of articles
3.	Analysis & Interpretation	5	Critically analyses the product performance, advantages, and limitations	Good analysis with minor shortcomings	Basic analysis provided
4.	Presentation & Communication	5	Well-organized report/presentation with clear communication and proper references	Organized presentation with minor errors	Average presentation and communication
	Total	20			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12			12	2
CO2	24	24			24	3
CO3	24	24			24	3
CO4			20		10	2
CO5			20	20	20	2
CO6				20	10	2
Total	60	60	40	40	100	

Note: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC201	ELECTRONIC DEVICES		SEMESTER				II	
Prerequisites			Category	ES(PC)	Credits		4	
NIL			Hours/ Semester	L	T	P	SL	TH
				45	0	45	30	120
COURSE OBJECTIVES								
1.	To understand the basics of semiconductors.							
2.	To understand the fundamentals of semiconductor diodes.							
3.	To design basic application circuits using diodes.							
4.	To acquaint with the construction, theory and operation of Bipolar and Field Effect Transistors.							
5.	To apply the knowledge in electronic circuits.							
UNIT - I		SEMICONDUCTORS						9+9
Semiconductor: Types, Conductivity, Electron energy levels and energy band diagram, Carrier concentration, Mass action law, Characteristics and behaviour of intrinsic semiconductors, Variation in properties with temperature, Carrier drift and diffusion, Current density equation, Excess carrier generation and recombination rates, Carrier life time. Continuity equation. Practical: Study of types of semiconductor.								
UNIT - II		SEMICONDUCTOR DIODES						9+9
Energy band diagram of open – circuited PN junction, Forward and reverse bias characteristics, Diode resistance, Transition and diffusion capacitance, Effect of temperature on diode behavior. Special Diodes: Zener diode – breakdown mechanisms and voltage regulation, Varactor diode, Tunnel diode, Photo diode – construction, operation, and applications. Practical: Characteristics of PN Junction Diode and Zener Diode. Characteristics of photodiode.								
UNIT - III		DIODE APPLICATIONS AND POWER SUPPLY						9+9
Clipper and clamper circuits, Half-wave, full-wave and bridge rectifiers with resistive load. Analysis for Vdc and ripple voltage with C, L, L-C and C-L-C filters. Voltage multipliers, Voltage Regulators – Zener diode regulator. Switched Mode Power Supply (SMPS). Practical: Design of Clippers and Clampers. Measurement of ripple factor of Rectifiers with and without capacitor filter.								
UNIT - IV		BIPOLAR JUNCTION TRANSISTORS						9+9
Bipolar Junction Transistors: Construction, working, characteristics in CB, CE, and CC configurations, regions of operation, current gain, input/output characteristics, Early effect. Other Devices: Multi-emitter transistor – construction and applications. Practical: Characteristics of CE/CB/CC configurations of Bipolar transistors.								
UNIT - V		FIELD EFFECT TRANSISTORS						9+9
Field Effect Transistors: JFET – construction, working, characteristics, parameters. MOSFET, MOS capacitor, depletion and enhancement modes, nMOS and pMOS, threshold voltage, transfer and output characteristics. CMOS – introduction and basic operation. Practical: Drain and Transfer Characteristics of JFET and MOSFET.								
L:45, P:45, SL:30, Total:120 Hours								

Weightage: Continuous Assessment 50% End Semester Examinations 50%														
TEXT BOOKS:														
1.	A.S. Sedra and K.C. Smith, Microelectronic Circuits, 8 th edition, Oxford University Press, 2020.													
2.	S. Salivahanan and N. Suresh kumar, "Electronic Devices and Circuits", 5e, McGraw Hill Education, 2022.													
REFERENCE BOOKS:														
1.	Donald A. Neamen. "Semiconductor Physics and Devices" 4 th Edition, McGraw Hill Education 2021.													
2.	Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" 11 th edition, PHI, 2017.													
3.	Ben G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices" 7th edition, Pearson, 2015.													
4.	Floyd, T. L. "Electronic Devices: Conventional Current Version", 10e, Pearson Education, 2021.													
E-RESOURCES:														
1.	https://nptel.ac.in/courses/108108112													
2.	https://nptel.ac.in/courses/117103063													
3.	http://www.electronics-tutorials.ws/													
4.	https://onlinecourses.nptel.ac.in/noc21_ee80/preview													
5.	https://nptel.ac.in/courses/108101091													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to											Mapping POs		Mapping PSOs	
CO1	Understand the characteristics of semiconductor diodes and transistors.										--			
CO2	Design and analyze clipper, clamper and power supply circuits.										PO1, PO3		PSO1	
CO3	Analyse the various parameters of transistors.										PO2			
CO4	Compare and evaluate different configurations of transistors.										PO2			
CO5	Use simulation tools to analyze the behaviour of electronic devices.										PO5, PO9, PO11		PSO1, PSO2	
CO6	Perform experiments as a team to evaluate and compare the characteristics of electronic components.										PO4, PO8, PO11		PSO1, PSO3	
The Course Articulation Matrix (CAM) for defined COs:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2	3		3									3		
CO3		3												
CO4		3												
CO5					3				3		3	2	2	
CO6				3				3			3	3		3

Activities:

- | | |
|----|---|
| 1. | Simulation-Solution to application-oriented problems using software (CO5) |
| 2. | Case Study (CO6)/Technical Seminar Presentation (CO6) (Independent study) |

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Problem formulation	20	Problem is clearly formulated with correct specifications.	Problem is defined, but some specifications are incomplete	Problem is defined, but specifications are unclear
2.	Circuit design & construction	30	Accurate circuit design and proper construction of network	Correct design with minor errors in construction	Incomplete or incorrect circuit design
4.	Verification & analysis of results	30	Results are correctly verified and well justified using analysis	Results are verified but justification is limited	Results are not properly verified or unclear
5.	Report presentation	20	Report is well structured, clear and professionally presented	Report is structured but needs improvement	Poorly structured report
	Total	100			

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Understanding of circuit simulation tools	20	Clearly demonstrates correct use of simulation tools for circuit analysis	Simulation tools used with minor errors	Limited understanding of simulation tools
2.	Simulation setup & circuit modelling	30	Correct circuit modeling with accurate parameters and setup	Minor errors in modeling or parameter selection	Incomplete or incorrect circuit modeling
3.	Analysis of waveforms & results	30	Accurate interpretation of waveforms, frequency response, and results	Results interpreted with minor errors	Poor or unclear interpretation of results
4.	Presentation & communication of results	20	Results are well-organized and clearly presented using graphs and plots	Presentation is acceptable but needs improvement	Poorly structured presentation
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Theory Component				Laboratory Component		Percentage allocation	Mapping Strength
	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
CO1	12	12					6	1
CO2	24	24			70	70	47	3
CO3	12	12			20	20	16	2
CO4	12	12			10	10	11	2
CO5			40				10	2
CO6				40			10	2
Total	60	60	40	40	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26HMC02	தமிழரும் தொழில்நுட்பமும் B.E. (அனைத்து துறைகளுக்கும் பொதுவானது)	பருவம்	II
முன்தேவைகள்:	Credits	HM	Credits
1			
தமிழ்மொழி மற்றும் இலக்கியத்தின் அடிப்படைகள்	Hours/ Semester	L	T P SL TH
		15	0 0 15 30
பாடநோக்கங்கள்			
1.	நெசவுத் தொழில்நுட்பம் மற்றும் மட்பாண்டத் தொழில்நுட்பம் குறித்த அறிவைப்பெறுதல்.		
2.	சங்ககாலம் மற்றும் ஆங்கிலேயர் ஆட்சிக்கால கட்டிட வடிவமைப்பு மற்றும் கட்டுமானத் தொழில்நுட்பங்களை அறிதல்.		
3.	உற்பத்தித்தொழில்நுட்பங்களைப் பற்றிய புரிதலை வளர்த்தல்.		
4.	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்ப அறிவைப்பெறுதல்.		
5.	அறிவியல் தமிழ் மற்றும் தமிழ் கணினியியல் வளர்ச்சியை அறிதல்.		
அலகு- I நெசவு மற்றும் பாணை தொழில்நுட்பம் 3			
சங்ககாலத்தில் நெசவுத்தொழில் - பாணை தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.			
அலகு- II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3			
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபொட்டுத்தலங்கள் - நாயக்கர்காலக் கோயில்கள் - மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ்காலத்தில் சென்னையில் இந்தோசாரோ செனிக்கட்டிடக்கலை.			
அலகு- III உற்பத்தித் தொழில்நுட்பம்: 3			
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலொற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்குமணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.			
அலகு- IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் 3			
வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் அணைகள், ஏரிகள், குளங்கள் மற்றும் மதகு அமைப்புகள் சோழர்கால குமிழித்தூம்பின் முக்கியத்துவம் கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்கான கிணறு வடிவமைப்புகள் வேளாண்மை மற்றும் வேளாண் செயலாக்கம் கடல் மற்றும் பெருங்கடல் அறிவு மீன் பிடித்தல், முத்துக்குளித்தல் மற்றும் சங்கு மூழ்குதல் அறிவுசார்ந்த சமூக அமைப்பு அறிவியல் தமிழின் வளர்ச்சி தமிழ் கணினியியல் தமிழ் நூல்களின் மின்னாக்கம் தமிழ் மென்பொருள் வளர்ச்சி தமிழ் இணையக்கல்விக்கழகம் தமிழ் மின்னணு நூலகம் இணையத்தமிழ் அகராதிகள் சொற்குவைத் திட்டம்			

அலகு- V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:	3
அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி- தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின்நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.		
L:15, SL:15, Total:30 Hours		
மதிப்பீட்டுபங்கு: தொடர் மதிப்பீடு: 40% பருவ இறுதித்தேர்வுகள்: 60%		
குறிப்புநூல்கள்:		
1.	பி .டி .சீனிவாச அய்யங்கார், தமிழர்களின் வரலாறு (History of the Tamils), கியான் பப்ளிஷிங் ஹவுஸ், 2020.	
2.	கே .ஏ .நீலகண்டசாஸ்திரி, சங்க இலக்கியம் :அதன் சமயங்களும் பண்பாடுகளும் (Sangam Literature: Its Cults and Cultures), ஸ்வாதி பப்ளிகேஷன்ஸ், 2006.	
3.	சித்ராமாதவன், தமிழ்நாட்டின் வரலாறும் பண்பாடும் (History and Culture of Tamil Nadu), டி.கே .பிரிண்ட் வேர்ல்ட், 2005.	
4.	ஆர் .பொன்னுசாமி, தமிழ்கணினியியல் (Tamil Computing), அலைட் பப்ளிஷர்ஸ் பிரைவேட் லிமிடெட், 2025.	
5	எஸ் .முத்துராமலிங்கம் & மு .சரவணகுமார், தமிழர்களும் தொழில்நுட்பமும் (Tamils and Technology), விஜய்நிக்கோல் இம்பிரிண்ட்ஸ் பிரைவேட் லிமிடெட், 2024	
மின்னணுவளங்கள்:		
1.	https://atlanticbooks.com/products/history-of-the-tamils-from-the-earliest-times-to-600-a-d-9788121235518	
2.	https://books.google.co.in/books/about/Sangam_Literature_Its_Cults_and_Cultures.html?id=j1ZsnQEA_CAAJ&redir_esc=y	
3.	https://books.google.co.in/books/about/History_and_Culture_of_Tamil_Nadu	
4.	https://www.booksamillion.com/p/Tamil-Computing/R-Ponnusamy/9789390951055	
5.	https://www.amazon.in/Tamils-Technology-English-S-Muthuramalingam/dp/8119243307	
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		
CO1	நெசவு மற்றும் மட்பாண்டத் தொழில்நுட்பம் பற்றிய அறிவைப்பெறுவர்.	PO9
CO2	சங்ககாலம் மற்றும் ஆங்கிலேயர்கால கட்டிட வடிவமைப்பு மற்றும் கட்டுமானத் தொழில்நுட்பங்களை அறிந்திருப்பர்.	PO9
CO3	உற்பத்தித் தொழில்நுட்பங்களைப் புரிந்து கொள்வர்.	PO9
CO4	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பத் திறன்களைப் பெறுவர்.	PO9
CO5	அறிவியல் தமிழ் மற்றும் தமிழ் கணினியியல் வளர்ச்சி குறித்த அறிவைப்பெறுவர்.	PO9, PO11
CO6	களப்பணி மற்றும் மின்னணு கற்றல் நடவடிக்கைகள் மூலம் தமிழ் பாரம்பரியத்தைப் புரிந்து கொள்வர்.	PO9, PO11
		PSO1
		PSO3
		PSO3

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1									3					
CO2									3					
CO3									3			2		
CO4									3					
CO5									3		2			2
CO6									3		2			2

செயல்பாடுகள்:

1.	CO5: - அறிவியல் தமிழின் வளர்ச்சி வரலாற்றை விளக்கும் அறிக்கை தயாரித்தல். - தமிழ் மென்பொருட்கள், எழுத்துருக்கள் மற்றும் மின்னணு தளங்கள் குறித்த PowerPoint வழங்கல் தயாரித்தல். - இணையத்தமிழ் அகராதி, தமிழ் இணையக்கல்விக்கழகம் மற்றும் தமிழ் மின்னணு நூலகப் பயன்பாட்டை விளக்குதல். - Unicode கருவிகளைப் பயன்படுத்தி தமிழ் தட்டச்சு மற்றும் வடிவமைப்பு செயல்முறை பயிற்சி. - நவீன அறிவியல் மற்றும் தொழில்நுட்பத் தகவல் பரிமாற்றத்தில் தமிழின் பங்கு குறித்த குழு விவாதம்.
2.	CO6: - பாரம்பரியத்தளங்கள் / அருங்காட்சியகங்கள் / கோயில்களுக்கு களப்பயணம் செய்து புகைப்படங்களுடன் அறிக்கை சமர்ப்பித்தல். - உள்ளூர் கலாச் சாரப்பாரம் பரியம் குறித்த ஆவணத் திட்டம் தயாரித்தல். - தமிழ் தொழில்நுட்ப சாதனைகள் குறித்த போஸ்டர் அல்லது விளக்கப்படம் உருவாக்குதல். - சங்ககால அறிவியல் மற்றும் தொழில்நுட்ப நடைமுறைகள் குறித்த கருத்தரங்கு நடத்துதல். - தமிழ் பாரம்பரிய அம்சங்களை வெளிப்படுத்தும் மின்னணு ஸ்கிராப்புத்தகம் அல்லது e-Portfolio உருவாக்குதல், பண்டைய தமிழ் தொழில்நுட்பம் அல்லது அறிவு அமைப்புகளில் ஏதேனும் ஒன்றை அடிப்படையாகக் கொண்ட வழக்குக் கூற்று வழங்குதல்.

CO5 மதிப்பீட்டு அளவுகோல்கள்:

வரி சை எண்	அளவுகோல்	மதிப் பெண் கள்	சிறப்பு (7-8)	நல்லது (4-6)	திருப்திகரமானது (1-3)
1.	தமிழ் பாரம்பரிய அறிவு	8	தமிழ் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டு பாரம்பரியத்தை முழுமையாகவும் துல்லியமாகவும் விளக்குகிறது.	நல்ல புரிதலை வெளிப்படுத்துகி றது, சில சிறிய விடுபாடுகள் இருக்கலாம்.	அடிப்படை அறிவை மட்டுமே காட்டுகிறது; விவரங்கள் குறைவாக உள்ளன.

2.	வரலாற்றுப் புரிதல்	8	வரலாற்றுப் பின்னணி மற்றும் அதன் முக்கியத்துவத்தை பொருத்தமான எடுத்துக்காட்டுகளுடன் தெளிவாக விளக்குகிறது.	வரலாற்றுப் பின்னணியை சில எடுத்துக்காட்டுகளுடன் விளக்குகிறது.	வரலாற்றுப் பின்னணி குறித்த விளக்கம் மிகவும் வரையறுக்கப்பட்டுள்ளது.
3.	தற்காலப் பொருத்தம்	8	பாரம்பரிய அறிவையும் சாதனைகளையும் தற்போதைய பயன்பாடுகளுடன் திறம்பட இணைக்கிறது.	பாரம்பரிய அறிவை நவீன பயன்பாடுகளுடன் ஒரளவு தெளிவாக தொடர்புபடுத்துகிறது.	சில நவீன தொடர்புகளை மட்டுமே அடையாளம் காட்டுகிறது.
4.	வழங்கல் திறன்	8	உள்ளடக்கம் சிறப்பாக ஒழுங்குபடுத்தப்பட்டு, காட்சிப் பூர்வமாக கவர்ச்சிகரமாகவும் பயனுள்ளதாகவும் வழங்கப்படுகிறது.	உள்ளடக்கம் நன்கு ஒழுங்குபடுத்தப்பட்டு, சில குறைகளுடன் வழங்கப்படுகிறது.	வழங்கல் அடிப்படை நிலையில் உள்ளது; தெளிவு மற்றும் ஒழுங்கமைப்பு குறைவாக உள்ளது.
5.	தொடர்புத் திறன்	8	கருத்துக்கள் தெளிவாகவும் நம்பிக்கையுடனும் ஆதாரங்களுடன் விளக்கப்படுகின்றன.	கருத்துக்கள் போதுமான ஆதாரங்களுடன் தெளிவாக வெளிப்படுத்தப்படுகின்றன.	கருத்துக்கள் புரியும் வகையில் இருந்தாலும் தெளிவு, நம்பிக்கை அல்லது ஆதாரங்கள் குறைவாக உள்ளன.
	மொத்தம்	40			

CO6 மதிப்பீட்டு அளவுகோல்கள்:

வரி சை எண்	அளவுகோல்	மதிப் பெண் கள்	சிறப்பு (7-8)	நல்லது (4-6)	திருப்திகரமானது (1-3)
1.	அறிவின் பயன்பாடு	8	தமிழ் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டு கருத்துக்களை செயல் முறைப்பணிகளில் திறம்படப் பயன்படுத்துகிறது.	கருத்துக்களை சரியாகப் பயன்படுத்துகிறது; குறைந்த வழிகாட்டுதல் தேவைப்படுகிறது.	அடிப்படை அளவில் மட்டுமே கருத்துக்களைப் பயன்படுத்துகிறது.

2.	திட்ட செயல்படுத்தல்	8	திட்டம் முழுமையானதாகவும் புதுமையானதாகவும் நன்கு திட்டமிடப்பட்டு வெற்றிகரமாக நிறைவேற்றப்பட்டுள்ளது.	திட்டம் நன்றாக செயல்படுத்தப்பட்டுள்ளது; சில சிறிய குறைகள் உள்ளன.	குறைந்தபட்ச தேவைகளை பூர்த்தி செய்கிறது; ஆனால் ஆழம் மற்றும் முழுமை குறைவாக உள்ளது.
3.	ஆதாரங்கள் மற்றும் வளங்களின் பயன்பாடு	8	பொருத்தமான தரவுகள், ஆதாரங்கள் மற்றும் எடுத்துக்காட்டுகளை திறம்படப் பயன்படுத்துகிறது.	பொருத்தமான வளங்களைப் பயன்படுத்தி போதுமான ஆதாரங்களை வழங்குகிறது.	குறைந்த அளவிலான வளங்கள் மற்றும் ஆதாரங்களை மட்டுமே பயன்படுத்துகிறது.
4.	வழங்கல் திறன்	8	கண்டறிவுகளை தெளிவாகவும் தொழில் முறையாகவும் திறம்படவும் வழங்குகிறது.	கண்டறிவுகள் தெளிவாக வழங்கப்படுகின்றன; சில சிறிய குறைகள் உள்ளன.	வழங்கல் போதுமானதாக இருந்தாலும் தெளிவு, ஒழுங்கமைப்பு அல்லது தொழில் முறைத்தன்மை குறைவாக உள்ளது.
5.	ஆவணப்படுத்தல் தரம்	8	ஆவணங்கள் முழுமையாகவும் துல்லியமாகவும் ஒழுங்குபடுத்தப்பட்டும் சரியான வடிவமைப்புகளும் உள்ளன.	ஆவணங்கள் முழுமையாகவும் ஒழுங்காகவும் உள்ளன; சில சிறிய விடுபாடுகள் இருக்கலாம்.	ஆவணங்கள் போதுமானதாக இருந்தாலும் விவரம், துல்லியம் அல்லது ஒழுங்கமைப்பு குறைவாக உள்ளது.
மொத்தம்		40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26HMC02	TAMILS AND TECHNOLOGY B.E. (Common to all Branches)		SEMESTER				II	
Prerequisites			Category	HM	Credits			1
Basics of Tamil Language and Literature.			Hours/ Semester	L	T	P	SL	TH
				15	0	0	15	30
COURSE OBJECTIVES								
1.	To obtain the knowledge of weaving and ceramic technology.							
2.	To familiarize about design and construction technology during Sangam age and British period.							
3.	To know about the manufacturing technologies.							
4.	To obtain the knowledge of agriculture and irrigation technology.							
5.	To know about the development of Scientific Tamil and Tamil computing.							
UNIT - I		WEAVING AND CERAMIC TECHNOLOGY						3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.								
UNIT - II		DESIGN AND CONSTRUCTION TECHNOLOGY						3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period								
UNIT - III		MANUFACTURING TECHNOLOGY						3
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.								
UNIT - IV		SCIENCE, TECHNOLOGY AND KNOWLEDGE SYSTEMS OF TAMILS						3
Agriculture and Irrigation Technology – Dam, Tank, Ponds and Sluice Systems – Significance of KumizhiThoompu of the Chola Period – Animal Husbandry and Wells Designed for Cattle Use – Agriculture and Agro-Processing – Knowledge of Sea and Ocean – Fisheries, Pearl and Conch Diving – Knowledge-Specific Society – Development of Scientific Tamil – Tamil Computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.								
UNIT - V		ACTIVITY AND PROJECT WORK						3
Prepare of models/charts related to ancient Tamil technologies such as irrigation systems – shipbuilding - weaving, pottery – temples - and coin minting. Document and present on Tamil scientific and technological heritage based on literary – archaeological - and historical sources - undergo a Field visit to heritage sites – museums – temples - archaeological sites - handicraft centre’s - or traditional industries and submission of a field report. Study and digitally document of Tamil inscriptions - hero stones – temples - traditional occupations -or local heritage resources.								
L:15, SL:15, Total:30 Hours								
Weightage:								
Continuous Assessment: 40%								
End Semester Examinations: 60%								

REFERENCE BOOKS:														
1.	"History of the Tamils", P.T. Srinivasa Iyengar, Gyan Publishing House, 2020													
2.	"Sangam Literature: Its Cults and Cultures", K.A. Nilakanta Sastri, Swathi Publications, 2006													
3.	"History and Culture of Tamil Nadu", Chitra Madhavan, D.K. Print world, 2005													
4.	"Tamil Computing", R. Ponnusamy, Allied Publishers Pvt. Ltd, 2025													
5.	"Tamils and Technology", S Muthuramalingam, M Saravanakumar, Vijay Nicole Imprints Pvt. Ltd., 2024													
E-RESOURCES:														
1.	https://atlanticbooks.com/products/history-of-the-tamils-from-the-earliest-times-to-600-a-d-9788121235518													
2.	https://books.google.co.in/books/about/Sangam_Literature_Its_Cults_and_Cultures.html?id=j1ZsnQEACAAJ&redir_esc=y													
3.	https://books.google.co.in/books/about/History_and_Culture_of_Tamil_Nadu													
4.	https://www.booksamillion.com/p/Tamil-Computing/R-Ponnusamy/9789390951055													
5.	https://www.amazon.in/Tamils-Technology-English-S-Muthuramalingam/dp/8119243307													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to										Mapping POs		Mapping PSOs		
CO1	Obtain the knowledge about weaving and ceramic technology.									PO9		-		
CO2	Familiarize about design and construction technology during Sangam age and British period.									PO9		-		
CO3	Understanding about the manufacturing technologies.									PO9		PSO1		
CO4	Acquire the skills in agriculture and irrigation technology.									PO9		-		
CO5	Acquire the knowledge about the development of Scientific Tamil and Tamil computing.									PO9, PO11		PSO3		
CO6	Develop an understanding of Tamil heritage through field-based and digital learning activities.									PO9, PO11		PSO3		
The Course Articulation Matrix (CAM) for defined COs:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1									3					
CO2									3					
CO3									3			2		
CO4									3					
CO5									3		2			2
CO6									3		2			2

Activities:

1.	CO5: Acquire the knowledge about the development of Scientific Tamil and Tamil Computing 1. Prepare a report on the evolution of Scientific Tamil, highlighting key milestones and contributors. 2. Create a PowerPoint presentation on Tamil computing tools, including Tamil software, fonts, and digital platforms. 3. Demonstrate the use of online Tamil dictionaries, Tamil Virtual Academy, and Tamil Digital Library. 4. Conduct a hands-on activity on typing and formatting Tamil text using Unicode tools. 5. Group discussion on the role of Tamil in modern science and technology communication.
2.	CO6: Develop an understanding of Tamil heritage through field-based and digital learning activities 1. Organize a field visit to heritage sites, museums, temples and submit a detailed report with photographs. 2. Prepare a documentation project on local cultural heritage (architecture, crafts, inscriptions, or traditions). 3. Create a poster or chart on Tamil technological achievements (irrigation systems, shipbuilding, metallurgy) 4. Conduct a group seminar on Sangam age scientific and technological practices. 5. Develop a digital scrapbook or e-portfolio showcasing Tamil heritage elements, present a case study on any one ancient Tamil technology or knowledge system.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (7-8)	Good(4-6)	Satisfactory (1-3)
1.	Knowledge of Tamil Heritage	8	Demonstrates and understanding of Tamil scientific, technological, and cultural heritage with accurate details.	Demonstrates good understanding with minor omissions.	Demonstrates basic understanding with limited details
2.	Historical Understanding	8	Clearly explains historical context and significance with relevant examples.	Explains historical context with some supporting examples.	Provides limited explanation of historical context.
3.	Contemporary Relevance	8	Effectively relates traditional knowledge and achievements to present-day applications and issues.	Relates traditional knowledge to modern applications with some clarity.	Identifies a few modern connections.
4.	Presentation Skills	8	Content is well-organized, visually appealing, and presented effectively.	Content is organized and presented clearly with minor shortcomings.	Content is organized and presented clearly with minor shortcomings.
5.	Communication Skills	8	Ideas are communicated clearly, confidently, and engagingly with appropriate supporting evidence.	Ideas are communicated clearly with moderate confidence and adequate support.	Communication is understandable but lacks clarity, confidence, or supporting evidence.
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (7-8)	Good(4-6)	Satisfactory (1-3)
1.	Application of Knowledge	8	Effectively applies Tamil scientific, technological, and cultural concepts to practical tasks and projects.	Applies concepts correctly with minor guidance.	Applies concepts at a basic level with limited effectiveness.
2.	Project Execution	8	Project is comprehensive, innovative, well-planned, and successfully completed.	Project is well-executed with minor shortcomings.	Project meets minimum requirements but lacks depth or completeness.
3.	Use of Evidence and Resources	8	Effectively uses relevant data, sources and examples to support project outcomes.	Uses appropriate resources with adequate supporting evidence.	Uses limited resources and supporting evidence.
4.	Presentation Skills	8	Presents findings clearly, professionally, and effectively.	Presents findings clearly with minor shortcomings.	Presentation is adequate but lacks clarity, organization, or professionalism.
5.	Documentation Quality	8	Documentation is comprehensive, accurate, well-organized and properly formatted.	Documentation is complete and organized with minor omissions.	Documentation is adequate but lacks detail, accuracy, or proper organization.
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	12	2
CO2	24	24	-	-	24	3
CO3	12	12	-	-	12	2
CO4	12	12	-	-	12	2
CO5	-	-	40	-	20	2
CO6	-	-		40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EEEC01	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING		SEMESTER				II	
Prerequisites			Category	ES(G)	Credit			4
			Hours/ Semester	L	T	P	SL	TH
				45	0	45	30	120
COURSE OBJECTIVES								
To impart foundational knowledge in principles and applications of electrical and electronics engineering.								
UNIT – I	DC CIRCUITS							9+9
Electrical circuit elements: Resistor (R), Inductor (L) and Capacitor (C) – Independent Voltage and Current Sources – Ohm’s Law and Kirchhoff’s Laws – Resistance in Series and Parallel Circuits – Voltage Division and Current Division Rules – Analysis of simple electrical circuits with DC excitation using fundamental laws (Mesh and Nodal Analysis) – Superposition Theorem – Thevenin’s Theorem. Practical: Verification of Kirchhoff’s Law, Superposition theorem and Thevenin’s theorem. Measurement of time constant of Series / Parallel R-C circuit. Activities; Solving Problems in DC electric circuits.								
UNIT – II	AC CIRCUITS							9+9
Introduction to Single-Phase AC Circuits – Representation of Sinusoidal Waveforms: Average Value, RMS Value, Form Factor, Peak Factor and Phasor Representation – Analysis of Single-Phase AC Circuits consisting of RL, RC, and RLC Series Combinations: Impedance, Power factor, Power and Phasor diagram, Three-Phase AC Circuits: Voltage and Current Relationships in Balanced Star and Delta Connections. Practical: Sinusoidal steady state response of Series RL, and RC circuits – measurement of impedance and power factor. Measurement of three-phase power by two wattmeter method in three-phase circuits. Study of Resonance in Series RLC Circuit. Activities; Solving Problems in AC electric circuits.								
UNIT – III	ELECTRICAL MACHINES AND TRANSFORMERS							9+9
Construction, Principle of Operation, Types, Characteristics and Applications: DC Motor (Shunt and Series), BLDC Motor, Three-Phase Induction Motor, Single-Phase Induction Motors (Split-Phase and Capacitor-Start Capacitor-Run Type), Transformers (Core and Shell type). Practical: Speed control of DC shunt motor & Load test on DC shunt motor. Load test on single-phase transformer Measurement of core loss and full load copper loss in a single-phase transformer. Activities: Demonstration of working of DC and AC motor starters. Virtual demonstration of electrical machines and transformers.								
UNIT – IV	BASICS OF ELECTRONIC DEVICES, SENSORS AND TRANSDUCERS							9+9
Basic Structure of Semiconductor Devices – PN Junction Diode and Zener Diode – V-I Characteristics and Applications; Bipolar Junction Transistor (BJT): CE, CB, and CC Configurations and Working Principle – Operational Amplifier: Principle of Operation, Characteristics and Applications, Inverting and Non-Inverting, Summing and Differential Amplifiers.								

Practical:

V-I characteristics of PN junction diode and Zener diode.

Activities:

Virtual Demonstration of Hall Effect, Piezoelectric and Smart Sensors.

Virtual Demonstration of LVDT, Optical and digital transducer.

UNIT – V**BASICS OF POWER SYSTEMS, MEASUREMENTS AND WIRING****9+9**

Structure of Electrical Power Systems: Generation, Transmission, and Distribution – Earthing and Methods of Earthing – Protective Devices: SFU, MCB, MCCB, and ELCB.

Functional Elements of Measuring Instruments – Construction and Working Principle of Moving-Coil and Moving-Iron Instruments.

Practical:

Demonstration of House wiring, Stair-case wiring and Fluorescent lamp wiring.

Study of basic electrical safety precautions and use of measuring instruments such as voltmeter, ammeter and multimeter.

Activities:

Physical demonstration of House Wiring tools and components.

Physical Demonstration of Types of House Wiring.

Physical demonstration of Types of Wires and Cables.

L:45, P:45, SL:30, Total: 120 Hours**Weightage:**

Continuous Assessment 50%

End Semester Examinations 50%

TEXT BOOKS:

1. Kothari, D. P., and Nagrath, I. J., "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. Muthu Subramaniam. R., Salivaganan. R., and Muralidharan. K. A., "Basic Electrical and Electronics Engineering", Second Edition, Tata McGraw Hill, 2010.
3. Kulshreshtha. D.C., "Basic Electrical Engineering", Tata McGraw Hill, 2009.
4. Theraja, B. L., and Theraja, A. K., "A Textbook of Electrical Technology, Vol. I: Basic Electrical Engineering", S. Chand Publishing, 2014.

REFERENCE BOOKS:

1. Mehta. V. K., and Mehta, Rohit, "Principles of Electrical Engineering", S. Chand Publications, 2008.
2. Hughes. E., "Electrical and Electronics Technology", Pearson, 2010.
3. Bobrow. L. S., "Fundamentals of Electrical Engineering", Oxford University Press, 2011.

E-RESOURCES:

1. <https://nptel.ac.in/courses/117106108>

COURSE OUTCOMES (COs) /

At the end of the course, the students will have the ability to

**Mapping
POs**

**Mapping
PSOs**

CO1 Analyze the basic DC and AC electric circuits.

PO2

CO2 Apply electromagnetic principles to interpret the working of electrical machines and transformers.

PO1

CO3 Analyze the operation and characteristics of electronic devices.

PO2

CO4 Choose appropriate protective devices, earthing and measuring instruments in power system for safe electrical installation.

PO5, PO11

CO5	Apply knowledge of fundamental laws and theorems for solving problems in DC and AC electric circuits.	PO1, PO3, PO11	
CO6	Make an effective technical seminar presentation as a Team: Measuring instruments, sensors and transducers, Types of House wiring, Types of wires and Cable, DC and AC motor starters.	PO8, PO9, PO11	

The Course Articulation Matrix (CAM) for defined COs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1		3												
CO2	3													
CO3		3												
CO4					3						2			
CO5	3		3								2			
CO6								3	3		2			

Activities:

1.	Solving Problems in DC and AC electric Circuits. (CO5)
2.	Technical Seminar Presentation on Measuring instruments, sensors and transducers, Types of House wiring, Types of Wires and Cable, DC and AC motor starters. (CO6)

List of Experiments

	COs
1. Study of basic electrical safety precautions and use of measuring instruments such as voltmeter, ammeter, and multimeter.	CO4
2. Verification of Kirchhoff's Law.	CO1
3. Verification of Superposition / Thevenin's Theorem	CO1
4. Sinusoidal Steady-State Response of R-L and R-C Circuits – Impedance and Power factor Calculation and Verification / Study of Resonance in Series RLC Circuit/ Measurement of Time Constant of an R-C Circuit.	CO1
5. Measurement of Three-Phase Power by Two-Wattmeter Method in Three-Phase Circuits	CO1
6. Load Test on DC Shunt Motor.	CO2
7. Speed Control of DC Shunt Motor	CO2
8. Load Test on Single-Phase Transformer.	CO2
9. Measurement of Core Loss and Full-Load Copper Loss in a Single-Phase Transformer	CO2
10. V-I Characteristics of PN Junction Diode / Zener Diode.	CO3
11. Demonstration of House Wiring, Staircase Wiring and Fluorescent Lamp Wiring.	CO4

Laboratory Experiment Evaluation

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Aim	5	Have excellent knowledge on necessities of experiment. (5 or 4)	Have acceptable knowledge on necessities of experiment. (3 or 2)	Poor knowledge on necessities of experiment. (1)
2.	Identification of apparatus/ Software / Materials need.	5	Highly capable of conducting experiment, with minimal or no support. (5 or 4)	Able to conduct experiment with quantifiable support. (3 or 2)	Unable to conduct experiment. (1)
3.	Experimentation	15	Clearly able to define output and conclude result. (13 to 15)	Able to define output but notable to conclude result. (8 to 12)	Poor ability to define output. (1 to 7)
4.	Observation& Result	15	On-time legibly written record with all requirements and without mistake. (13 to 15)	On-time legibly written record but not with all requirements and without mistake. (8 to 12)	Poorly written record. (1 to 7)
5.	Record	5	Answered almost all questions. (5 or 4)	Answered some of the questions. (3 or 2)	Answered a few questions. (1)
6.	Vivavoice	5	Have excellent knowledge on necessities of experiment. (5 or 4)	Have acceptable knowledge on necessities of experiment. (3 or 2)	Poor knowledge on necessities of experiment. (1 or 0)
	Total	50			

Rubrics for evaluation: CO5 - Solving Problems in DC and AC electric circuits.

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Problem Understanding	25	Correctly interprets the problem and identifies the required parameters independently	Understands the problem with minor guidance	Requires significant guidance to understand the problem
2.	Formula Selection and Application	25	Selects and applies appropriate formulas/concepts accurately	Minor errors in formula selection or application	Incorrect or incomplete application of formulas
3.	Calculation Accuracy	25	Performs calculations accurately with correct units and logical steps	Minor calculation or unit errors	Frequent errors resulting in incorrect answers

4.	Result Interpretation and Presentation	25	Presents solutions systematically with correct interpretation and conclusions	Minor errors in presentation or interpretation	Incomplete or incorrect presentation and interpretation
	Total	100			

Rubrics for evaluation: CO6 - Technical Seminar Presentation on Instruments, Transducers, Sensors, and House Wiring.

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Technical Understanding	25	Demonstrates clear and thorough understanding of the topic	Demonstrates moderate understanding	Demonstrates basic understanding only
2.	Presentation and Communication Skills	25	Presents ideas clearly, confidently, and effectively	Presentation is understandable with minor issues	Presentation lacks clarity/confidence
3.	Report/Content Organization	25	Well-structured report/presentation with proper technical content	Adequate organization with minor errors	Poorly organized content/report
4.	Participation and Activity Involvement	25	Actively participates and contributes independently	Participates with occasional support	Limited participation and involvement
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Theory Component				Laboratory Component		Percentage Allocation	Mapping Strength
	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
CO1	44				40	40	31	3
CO2	16	16			30	30	23	3
CO3		22			10	10	10.5	2
CO4		22			20	20	15.5	2
CO5			40				10	2
CO6				40			10	2
Total	60	60	40	40	100	100	100	

Note: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26MEC01	ENGINEERING GRAPHICS		SEMESTER				II
Prerequisites		Category	ES(G)	Credits			4
Basic geometry and Usage of drawing instrument		Hours/ Semester	L	T	P	SL	TH
			30	45	0	45	120
COURSE OBJECTIVES							
1.	To impart knowledge on dimensions and drawing standards.						
2.	To explore the projection of points, lines, planes and solids.						
3.	To explore the section of solids with various cutting planes						
4.	To provide the understanding of orthographic and isometric views.						
5.	To provide the understanding of perspective views and its applications.						
UNIT - I	PLANE CURVES, PROJECTION OF POINTS AND LINES						15
Fundamentals: Drawing instruments, Drawing standards (BIS), Lettering in engineering, Sheet layout, elements of dimensioning, Systems of dimensioning. Construction of curves - ellipse, parabola, and hyperbola (eccentricity method only), Construction of cycloids, involutes - Drawing of tangents and normal to the above curves. Projection of points and Lines – Projections points in all four quadrants, Projections of straight lines located in first quadrant – parallel and inclined to both planes - determination of true length and true inclinations by rotating line method.							
UNIT - II	PROJECTION OF PLANES AND PROJECTION OF SOLIDS						15
Projections of plane surfaces - polygonal lamina and circular lamina, located in the first quadrant and inclined to both reference planes. Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.							
UNIT - III	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES						15
Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane. Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.							
UNIT - IV	ORTHOGRAPHIC PROJECTION						15
Orthographic Projection: First angle projection, Visualization concepts - Representation of three-dimensional objects - layout of views - Different views of inclined, curved and simple objects.							
UNIT - V	ISOMETRIC AND PERSPECTIVE PROJECTION						15
Isometric projection , Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders, cones and simple objects. (For Exam) Perspective Projection: Simple solids - Prism and Pyramid by visual ray method. (For practice only)							
L:30, T:45 SL:45, Total:120 Hours							

Weightage:

Continuous Assessment 40%

End Semester Examinations 60%

REFERENCE BOOKS:

1.	Natarajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.
2.	Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.
3.	Gopalakrishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001.
4.	Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008.
5.	Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.

E-RESOURCES:

1.	Online Resources (Open sources): 1. nptel.ac.in/courses/112102304 2. https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr25_ed52
2.	Engineering Drawing and Computer Graphics, Prof. Rajaram Lakkaraju (IIT Kharagpur) – https://onlinecourses.nptel.ac.in/noc22_me105/preview
3.	MIT Design Handbook: Engineering Drawing and Sketching – https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

CO1	Explain the fundamentals of engineering drawing, BIS standards, dimensioning methods, and standard drawing practices.	--	--
CO2	Construct engineering curves such as ellipse, parabola, hyperbola, cycloid, and involute, using standard drafting techniques.	PO1, PO2, PO3, PO5, PO10, PO11	PSO1, PSO2, PSO3
CO3	Apply the principles of projection to construct the projections of points, lines, planes, solids, sectional views, and surface developments.	PO1, PO2, PO3, PO5, PO10, PO11	PSO1, PSO2, PSO3
CO4	Apply projection principles to create orthographic, isometric, and perspective views of engineering objects using standard drawing practices.	PO1, PO2, PO3, PO5, PO10, PO11	PSO1, PSO2, PSO3
CO5	Construct engineering drawings of curves, projections, sectional views, and surface developments of simple solids using standard drafting instruments and BIS conventions.	PO1, PO2, PO3, PO5, PO10, PO11	PSO1, PSO2, PSO3
CO6	Create orthographic, isometric, and perspective drawings of engineering components and physical models to effectively communicate design and improve spatial visualization skills.	PO1, PO2, PO3, PO5, PO10, PO11	PSO1, PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 01	PSO 02	PSO 03
CO1														
CO2	3	2	2		2					2	1	3	2	1
CO3	3	3	2		2					1	1	3	2	1
CO4	3	2	3		2					1	1	3	3	1
CO5	3	3	2		2					1	1	3	2	1
CO6	3	2	3		2					2	1	3	3	2

Activities:

1.	Construct conic sections, cycloids, involutes, and spirals using drawing instruments and demonstrate their formation using physical models or CAD tools.
2.	Mini Design Project – Create the complete drawing of a simple engineering component (e.g., bracket, machine block, pipe support) including orthographic, isometric, sectional view and dimensions.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Accuracy of Engineering Curves	8	Curves are constructed accurately with correct dimensions and geometry	Minor errors in construction or dimensions	Noticeable errors affecting accuracy
2.	Projection and Sectional View Construction	10	Projections and sectional views are complete, correct, and clearly represented	Minor mistakes in views or missing details	Incomplete or incorrect representation
3.	Surface Development of Solids	8	Developments are accurate with correct geometry and layout	Minor dimensional or layout errors	Significant errors in development
4.	Use of Drawing Instruments and Standards	6	Proper use of instruments with BIS standards followed throughout	Small deviations from standards or instrument usage	Improper use of standards and instruments
5.	Neatness, Presentation, and Sheet Organization	8	Excellent line quality, lettering, dimensioning, and sheet layout	Acceptable presentation with few inconsistencies	Poor presentation and organization
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Accuracy of Orthographic Views	10	Produces complete and accurate orthographic views with correct dimensions and alignment	Produces views with minor dimensional or projection errors	Produces basic views with noticeable errors or incomplete details
2.	Quality of Isometric Representation	10	Drawings are accurate, proportionate, and clearly represent the object	Drawings are mostly accurate with minor proportional issues	Drawings show limited accuracy and representation
3.	Perspective Drawing Skills	8	Applies perspective principles correctly with realistic depth and proportions	Applies perspective concepts with minor errors	Demonstrates basic perspective drawing with several inaccuracy
4.	Visualization and Interpretation Skills	8	Easily visualizes and converts objects into multiple graphical views accurately	Demonstrates good visualization with few interpretation mistakes	Shows limited visualization and interpretation ability
5.	Drawing Standards, Neatness, and Presentation	4	Excellent line quality, dimensioning, lettering, and neat presentation	Presentation is clear with minor issues in neatness or standards	Presentation is acceptable but lacks consistency and neatness
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	10	10			10	2
CO2	10				5	1
CO3	40	20			30	2
CO4		30			15	2
CO5			40		20	3
CO6				40	20	3
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26MCS01		ENGINEERING SPRINTS			SEMESTER			II		
Prerequisites					Category	SD	Credits			0
Basic knowledge of calculus, differential equations, complex numbers and elementary integration techniques.					Hours/ Semester	L	T	P	SL	TH
						0	0	15	15	30
COURSE OBJECTIVES										
1.	To strengthen conceptual understanding of fundamental engineering concepts.									
2.	To spark curiosity in students’ Minds.									
3.	To focus on teaching through a problem-solving approach using Street Fight Engineering principles pioneered.									
4.	To foster the growth of functional independence and self-driven learning habits									
5.	To maximize the interest levels toward learning - as students aspire to create meaningful changes in the world.									
UNIT - I		STREET FIGHTING ENGINEERING								3
Why Street fight engineering - How to street fight engineering - Decode real-world problems - Observe key patterns - Relationship study - Derive actionable inferences - Perform data driven insights- Generate concepts and case studies										
UNIT - II		PROGRAMMING PARADIGM								3
Need for programming - Outside box thinking to solve problems - Need for algorithms and data structures -Flowcharts & Algorithms - Memory Allocation - Conditions and loops - Creating effective functions - Case studies - Visual Programming - Types of programming languages& paradigms - Getting started with development - Build & test an algorithm - best practices										
UNIT - III		BRAINS OF MACHINES								3
Key Innovations in Tesla Electric car - Case study - Brains of Electric cars - Transdisciplinary systems - Adapting Transdisciplinary systems to Accelerate innovation - Idea Hexagon - Exercise to think new innovations using Idea Hexagon - Brains of Digital camera										
UNIT - IV		MACHINES THAT MAKE-UP THE WORLD								3
Basic of Electronics Passive Components -Need for sensors & Actuators - Analyzing & Understanding electronic circuits - How to Build a Basic Custom Hardware - Bootloader& its purpose										
UNIT - V		ENGINEERING THE REAL WORLD								3
Real-world as systems - Introduction to Systems Thinking - Stock and Flow Diagrams - System Traps - Intervening in System - Living in a World of Systems										
Total:30 Hours										
Weightage:										
Continuous Assessment 100%										

REFERENCE BOOKS:			
1.	Learning to code: How to think like a programmer		
2.	How to find innovative ideas: Ramesh Raskar’s note		
3.	Case study: How Tesla changed the auto industry		
4.	Ultimate Guide: How to develop a new electronic hardware product		
5.	Think like a programmer: An introduction to creative problem solving		
E-RESOURCES:			
1.	Coursera, “Design Thinking for Innovation”, University of Virginia, https://www.coursera.org		
2.	“Engineering Systems and Innovation”, Massachusetts Institute of Technology, https://www.edx.org		
3.	MIT OpenCourseWare, “Engineering Systems Analysis for Design”, Massachusetts Institute of Technology, https://ocw.mit.edu		
4.	Stanford Online, “Design Thinking and Innovation”, Stanford University, https://online.stanford.edu		
5.	NPTEL, “Problem Solving Through Programming in C”, National Programme on Technology Enhanced Learning (NPTEL), https://onlinecourses.nptel.ac.in		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Remember and understand the concepts of Street Fighting Engineering, programming paradigms, innovation tools, basic electronics and systems thinking used in engineering applications.	-	-
CO2	Apply Street Fighting Engineering principles, algorithms and programming concepts to solve engineering problems.	PO1	PSO1
CO3	Analyze engineering problems using innovation methodologies, transdisciplinary systems and systems thinking approaches	PO2	PSO1
CO4	Investigate engineering systems involving electronics, sensors, actuators and hardware design through assignments and case studies.	PO3	PSO2
CO5	Solve real-world engineering problems by applying analytical thinking, data-driven insights and systematic problem-solving techniques.	PO5	PSO2
CO6	Communicate engineering concepts, innovative ideas, solutions and findings effectively through reports, presentations and technical documentation.	PO10	-

The Course Articulation Matrix (CAM) for defined Cos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 01	PSO 02	PSO 03
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-	1	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	1	-
CO6	-	-	-	-	-	-	-	-	-	3	-	-	-	-

Activities:

1.	Students shall analyse a real-world engineering problem using Street Fighting Engineering principles, systems thinking concepts and appropriate analytical tools. The activity may include problem identification, pattern analysis, inference generation and solution proposal.
2.	Students shall prepare a structured report or presentation on an innovative engineering product, programming application, electronic system or engineering case study highlighting methodology, findings and engineering significance.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Problem Identification	10	Real-world problem clearly identified and justified	Problem identified with minor gaps	Problem selection lacks clarity
2.	Analytical Thinking	10	Strong analysis and logical reasoning	Analysis adequate with minor errors	Limited analysis
3.	Application of Engineering Concepts	10	Concepts applied effectively and correctly	Mostly correct application	Weak application
4.	Solution Development	10	Innovative and feasible solution proposed	Solution acceptable	Solution incomplete
5.	Interpretation of Results	10	Results clearly interpreted with engineering relevance	Interpretation adequate	Weak interpretation
	Total	50			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Technical Communication	10	Ideas communicated clearly and professionally	Mostly clear communication	Communication needs improvement
2.	Organization of Report / Presentation	10	Well-structured and systematic	Minor organizational issues	Poor organization
3.	Use of Technical Content	10	Appropriate and accurate technical content	Minor inaccuracies	Limited technical content
4.	Presentation Skills	10	Highly effective presentation and explanation	Good presentation	Basic presentation
5.	Overall Academic Quality	10	Professional and high-quality work	Good quality work	Satisfactory quality
	Total	50			

26NCC01	NCC Course –I (Only for NCC Students)		SEMESTER				II		
Prerequisites			Category		-	Credits		2	
			Hours/ Semester		L	T	P	SL	TH
					30	0	0	30	60
COURSE OBJECTIVES									
1.	To Maintain the unity and disciplines to the students.								
UNIT - I		NCC GENERAL & NATIONAL INTEGRATION AND AWARENESS							6
Aims, Objectives and Organization of NCC – Incentives to NCC Cadets – Duties of NCC Cadets – NCC Camps: Types and Conduct – National Integration: Importance and Necessity – Factors Affecting National Integration – Unity in Diversity – Threats to National Security.									
UNIT - II		PERSONALITY DEVELOPMENT & LEADERSHIP DEVELOPMENT							6
Personality Development Capsule – Self Awareness – Empathy – Creative and Critical Thinking – Decision Making – Communication Skills – Group Discussion – Stress Emotions – Change Your Mindset – Interpersonal Relations and Teamwork – Time Management – Civil Sense – Career Counselling – SSB Procedures and Interview Skills; Leadership Capsule – Traits, Indicators, Motivation, Ethics and Honour Code – Case Studies: Shivaji, APJ Abdul Kalam, Deepa Malik, Maharana Pratap, Ratan Tata, Kiran Majumdar Shaw, Jhansi Ki Rani, Narayan Murthy, Prakash Padukone, Tipu Sultan, Rabindranath Tagore.									
UNIT - III		DISASTER MANAGEMENT AND HEALTH & HYGIENE							6
Disaster Management Capsule – Social Service and Community Development – Types of Disasters – Organization, Capability and Role of NCC Cadets – Fire Service and Fire Fighting – Initiative Training – Organization Skills – Do’s and Don’ts – Natural Disasters – Man-Made Disasters – Health and Sanitation – First Aid in Common Medical Emergencies – Treatment and Care of Wounds – Introduction to Yoga and Exercises.									
UNIT - IV		PRINCIPLES OF FLIGHT & GENERAL SERVICE KNOWLEDGE							6
Laws of Motion – Glossary Terms – Bernoulli’s Principle – Aerofoil – Forces Acting on Aircraft – Lift and Drag – Flaps and Slats – Stall – Thrust – Armed Forces and IAF Capsule – Modes of Entry in IAF – Civil Aviation – Aircraft Recognition – Latest Trends and Acquisitions.									
UNIT - V		NAVIGATION, AERO ENGINES, AIR CAMPAIGNS & AIRMANSHP							6
Requirements of Navigation – Glossary Terms – Maps – Map Reading – Basic Theory – Types of Engines – Piston Engines – Jet Engines – Turbo Prop Engines – Indo-Pak War 1971 – Operation Safed Sagar – Famous Air Heroes – Airmanship – Airfield Layout – Rules of the Air – Circuit Procedures – ATC RT Procedures – Aviation Medicine – Survival.									
L:30, P:0, SL :30, Total:60 Hours									
REFERENCE BOOKS:									
1.	William H. McRaven, <i>The Hero Code: Lessons Learned from Lives Well Lived</i> , Grand Central Publishing, 2019.								
2.	S. K. Mangal, <i>Leadership and Personality Development</i> , PHI Learning Pvt. Ltd., 2018.								
3.	N. V. K. Raju, <i>Disaster Management and Preparedness</i> , CBS Publishers, 2019.								
4.	A. K. Gandhi, <i>National Security and National Integration in India</i> , New Century Publications, 2017.								
5.	V. K. Sharma, <i>Fundamentals of Aviation and Air Navigation</i> , Himalaya Publishing House, 2018.								

E-RESOURCES:

1.	National Cadet Corps (NCC) https://indiancc.nic.in/
2.	Ministry of Defence, Government of India https://mod.gov.in/
3.	National Disaster Management Authority (NDMA) https://ndma.gov.in/
4.	Indian Air Force https://indianairforce.nic.in/

COURSE OUTCOMES (COs) /

At the end of the course, the students will have the ability to

Mapping POs

Mapping PSOs

CO1	Acquire knowledge about the history, organization, objectives, incentives, duties, and camps of NCC.	PO8, PO11	-
CO2	Understand the concept of national integration, national security, unity in diversity, and their significance in nation building.	PO6, PO8, PO11	PSO1
CO3	Apply principles of personality development, leadership, communication, teamwork, ethics, and decision-making in personal and professional life.	PO8, PO9, PO10,	PSO1
CO4	Understand the fundamentals of disaster management, health, hygiene, first aid, and the role of NCC cadets during emergencies and disaster situations.	PO6, PO7, PO8	PSO2
CO5	Understand the principles of flight, aviation systems, navigation, aero engines, armed forces, and airmanship practices.	PO1, PO2, PO8	PSO2
CO6	Demonstrate discipline, leadership, social responsibility, patriotism, and service-oriented attitudes through NCC training and community-oriented activities.	PO8, PO9, PO10, PO11	PSO3

The Course Articulation Matrix (CAM) for defined Cos

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PS O 01	PS O 02	PS O 03
C01	-	-	-	-	-	-	-	3	-	-	2	-	-	-
C02	-	-	-	-	-	2	-	3	-	-	2	2	-	-
C03	-	-	-	-	-	-	-	3	3	2	-	2	-	-
C04	-	-	-	-	-	2	2	3	-	-	-	-	2	-
C05	2	2	-	-	-	-	-	3	-	-	-	-	2	-
C06	-	-	-	-	-	-	-	3	3	3	2	-	-	3

Activities:

1.	Activity 1: Participate in NCC orientation programmes and awareness sessions to understand the organization, objectives, and role of NCC in nation building.
2.	Activity 2: Participate in leadership, personality development, and communication skill workshops to enhance teamwork, decision-making, and interpersonal skills.
3.	Activity 3: Participate in disaster management drills, first aid training, and community service activities to develop social responsibility and emergency response skills.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Knowledge of Aviation Concepts	25	Demonstrates comprehensive understanding of aviation and flight principles	Demonstrates good understanding with minor gaps	Demonstrates basic understanding
2.	Technical Interpretation	25	Accurately explains aviation systems and navigation concepts	Explains concepts with minor errors	Limited explanation of concepts
3.	Application and Analysis	25	Effectively relates theory to practical aviation scenarios	Adequately relates concepts to applications	Limited application of concepts
4.	Presentation and Communication	25	Presents ideas clearly and confidently	Communicates adequately with minor hesitation	Communication lacks clarity
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Discipline and Commitment	25	Consistently demonstrates discipline, punctuality, and commitment	Demonstrates good discipline with minor lapses	Demonstrates basic discipline
2.	Leadership and Teamwork	25	Effectively leads and collaborates with peers	Participates actively with minor limitations	Limited leadership and teamwork
3.	Social Responsibility and Service	25	Actively contributes to community service and social initiatives	Participates satisfactorily in service activities	Limited participation in service activities
4.	Patriotism and Ethical Conduct	25	Demonstrates strong patriotic values and ethical behavior	Demonstrates good values and conduct	Demonstrates basic awareness of values and ethics
	Total	100			

26MAC04	PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES B.E. (Common to CIVIL, ECE, MECH & METT)				SEMESTER			III		
Prerequisites					Category	BS	Credits		3	
Basic knowledge of calculus, differential equations, complex numbers and elementary vector calculus.					Hours/ Semester	L	T	P	SL	TH
						45	15	0	30	90
COURSE OBJECTIVES										
1.	To understand the formation and solution methods of partial differential equations including first order and higher order linear equations.									
2.	To develop knowledge in solving boundary value problems using Fourier series and separation of variables techniques for heat and wave equations.									
3.	To acquire understanding of analytic functions, harmonic functions and conditions for analyticity in complex analysis.									
4.	To learn conformal mapping techniques and standard complex transformations used in mathematical and engineering applications.									
5.	To understand complex integration methods, residue theorem and contour integration techniques for evaluating complex and real integrals.									
UNIT - I		PARTIAL DIFFERENTIAL EQUATIONS							9+3	
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange’s Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.										
UNIT - II		APPLICATIONS OF FOURIER SERIES TO PARTIAL DIFFERENTIAL EQUATION							9+3	
Classification of partial differential equations- Method of separation of variables – Solutions of one-dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation.										
UNIT - III		ANALYTIC FUNCTIONS							9+3	
Analytic functions – Necessary and sufficient conditions for analyticity - Properties of analytic functions – Harmonic conjugates – Construction of analytic function.										
UNIT - IV		CONFORMAL MAPPING							9+3	
Introduction to complex mapping - Conformal mapping – Condition for conformality – Standard mappings: $a + z, az, az + b, \frac{1}{z}, z^2, e^z$ and Bilinear transformations.										
UNIT - V		INTEGRATION OF COMPLEX FUNCTIONS							9+3	
Line integral - Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s and Laurent’s series – Singularities – Residues – Cauchy’s Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contours (excluding poles on real lines).										
L:45, T:15, SL:30, Total: 90 Hours										
Weightage:										
Continuous Assessment: 40%										
End Semester Examinations: 60%										

TEXT BOOKS:			
1.	Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley & Sons. , New Delhi, 2015.		
2.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45 th Edition, New Delhi, 2020.		
REFERENCE BOOKS:			
1.	Wylie C. R. and Barrett L. C, "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019.		
2.	Peter V.O Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt. Ltd., New Delhi, 2016.		
3.	Dennis G Zill, "Advanced Engineering Mathematics", Jones & Bartlett India P Ltd., New Delhi, 2017.		
E-RESOURCES:			
1.	NPTEL, "Partial Differential Equations", National Programme on Technology Enhanced Learning, https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ma28		
2.	NPTEL, "Complex Analysis", National Programme on Technology Enhanced Learning, https://nptel.ac.in/courses/111107056		
3.	MIT OpenCourseWare, "Differential Equations", Massachusetts Institute of Technology, https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/		
4.	Paul's Online Math Notes, "Partial Differential Equations and Complex Variables", Lamar University, https://tutorial.math.lamar.edu/classes/de/intropde.aspx		
5.	Wolfram Math World, "Partial Differential Equations, Analytic Functions, Conformal Mapping and Residue Theorem", Wolfram Research, https://mathworld.wolfram.com/AnalyticFunction.html		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Remember and understand the fundamental concepts and methods of partial differential equations, Fourier series applications, analytic functions, conformal mappings and complex integration, including PDE solution techniques, analyticity conditions, harmonic functions, mapping transformations, complex series expansions, and residue theory.	--	--
CO2	Apply the techniques of partial differential equations, Fourier series, analytic functions, conformal mappings and complex integration to solve mathematical and engineering problems involving heat and wave equations, complex transformations, contour integration and evaluation of real integrals using residue theory.	PO1	PSO1
CO3	Analyze mathematical and engineering problems using partial differential equations, Fourier series methods, analytic functions, conformal mappings and complex integration by selecting suitable analytical techniques, interpreting complex transformations, and examining the behaviour of functions and solutions in applied contexts.	PO2	PSO1
CO4	Develop mathematical models and analytical solution strategies using partial differential equations, Fourier methods, and complex analysis techniques for solving engineering and physical science problems.	PO3	PSO2
CO5	Investigate and solve assignment-based and application-oriented problems involving PDEs, conformal mappings and contour integration to enhance analytical reasoning and computational skills.	PO5	PSO2

C06	Communicate mathematical concepts, analytical solution procedures, graphical interpretations and results related to partial differential equations and complex analysis effectively through proper mathematical notation, assignments, presentations and structured report writing.	PO10	--
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The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
C01														
C02	3											3		
C03		2										2		
C04			1										1	
C05					3								1	
C06										3				
Avg	3	2	1		3					3		2.5	1	

Activities:

1.	Students shall solve selected assignment-based problems involving partial differential equations, Fourier series applications, analytic functions, conformal mappings and contour integration using suitable analytical and computational methods. This activity develops analytical reasoning, computational skill, and problem-solving ability in applied mathematics.
2.	Students shall prepare a short report or presentation on selected applications of PDEs, conformal mappings, analytic functions or residue theorem. This activity develops the ability to communicate mathematical procedures, graphical interpretations, results and conclusions effectively using proper notation and structured report writing.

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Selection of problem	8	Suitable application-based problem is selected and clearly understood	Problem is relevant, but needs minor clarity	Problem selection is basic or unclear
2.	Application of analytical method	8	Correct method is applied with proper steps	Method is mostly correct with minor errors	Method is incomplete or incorrect
3.	Accuracy of solution	8	Solution is accurate and well-presented	Minor errors are present	Major errors in solution
4.	Interpretation of results	8	Results are clearly interpreted with conclusion	Interpretation is limited	Interpretation is weak or missing

5.	Presentation and documentation	8	Work is neatly organized with clear numerical presentation and documentation	Presentation is good with minor organizational issues	Presentation is satisfactory but lacks consistency
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (9-10)	Good (6-8)	Satisfactory (1-5)
1.	Clarity of explanation	8	Concepts and procedures are clearly explained	Explanation is understandable with minor gaps	Explanation is unclear
2.	Use of notation, diagrams and representation	8	Proper notation, diagrams, graphs and outputs are used	Minor errors in notation or representation	Poor or missing representation
3.	Organization of report/ presentation	8	Well-structured and neatly presented	Organized, but needs improvement	Poorly organized or incomplete
4.	Communication of results	8	Results and conclusions are communicated effectively	Communication is adequate, but limited	Communication is weak
5.	Overall presentation and academic quality	8	Work demonstrates excellent academic quality and professionalism	Academic quality is good with minor issues	Academic presentation is satisfactory
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	12	2
CO2	24	24	-	-	24	3
CO3	16	16	-	-	16	2
CO4	8	8	-	-	8	1
CO5	-	-	40	-	25	3
CO6	-	-	-	40	25	3
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC301	ANALOG CIRCUITS – I		SEMESTER				III	
Prerequisites			Category	ES(PC)	Credits		3	
1. Electronic Devices			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
COURSE OBJECTIVES								
1.	To construct electronic circuits using basic electronic devices.							
2.	To design and analyse single stage and multistage amplifier circuits.							
3.	To acquaint with the frequency response of amplifiers.							
4.	To understand the principles and operation of large-signal amplifiers.							
5.	To design and analyse feedback amplifiers.							
UNIT - I		TRANSISTOR BIASING						9
BJT – Need for biasing – Load-line analysis – different biasing techniques of BJT – bias stability – MOSFET Circuits: Biasing by fixing VGS, biasing by fixing VG, and connecting a resistor in the source, Biasing using a drain-to-gate feedback resistor, and biasing using a current source.								
UNIT - II		MIDBAND ANALYSIS OF SMALL SIGNAL AMPLIFIERS						9
CE, CB and CC amplifiers – Method of drawing small-signal equivalent circuit – Midband analysis of various types of single stage amplifiers to obtain gain, input impedance and output impedance – Miller’s theorem – Comparison of CB, CE and CC amplifiers and their uses – CS, CG and CD (FET) amplifiers – Multistage amplifiers – Basic emitter coupled differential amplifier circuit – Bisection theorem – Differential gain – CMRR – Use of constant current circuit to improve CMRR.								
UNIT - III		FREQUENCY RESPONSE OF AMPLIFIERS						9
General shape of frequency response of amplifiers – Low-Frequency Response of Discrete-Circuit Common-Source and Common-Emitter Amplifiers – Internal Capacitive Effects and the High-Frequency Model of the MOSFET and the BJT – High-Frequency Response of the CS and CE Amplifiers – Hybrid – pi equivalent circuit of BJTs – General expression for frequency response of multistage amplifiers - Calculation of overall upper and lower cut off frequencies of multistage amplifiers								
UNIT - IV		LARGE SIGNAL AMPLIFIERS						9
Classification of amplifiers (Class A, B, AB, C and D), Efficiency of class A, RC coupled and Transformer-coupled power amplifiers. Class B complementary-symmetry, push-pull power amplifiers. Calculation of power output, efficiency and power dissipation. Heat flow calculations using analogous circuit. Heat sink design.								
UNIT - V		FEEDBACK AMPLIFIERS						9
Block diagram. Loop gain. Gain with feedback. Desensitivity of gain. Distortion and cut off frequencies with feedback. The four basic feedback topologies and the type of gain stabilized by each type of feedback. Input and Output resistances with feedback. Method of identifying feedback topology, feedback factor and basic amplifier configuration with loading effect of feedback network taken into account. Analysis of feedback amplifiers. Nyquist criterion for stability of feedback amplifiers.								
L:45, SL:45, Total: 90 Hours								
Weightage:								
Continuous Assessment 40%								
End Semester Examinations 60%								

TEXT BOOKS:														
1.	A.S. Sedra and K.C. Smith, Microelectronic Circuits, 8 th edition, Oxford University Press, 2020.													
2.	S. Salivahanan and N. Suresh kumar, "Electronic Devices and Circuits", 5e, McGraw Hill Education, 2022.													
REFERENCE BOOKS:														
1.	Donald A. Neamen. "Semiconductor Physics and Devices" 4 th Edition, McGraw Hill Education 2021.													
2.	Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" 11 th edition, PHI, 2017.													
3.	Ben G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2015.													
4.	Bell, D. A. "Electronic devices and circuits", 5th edition, Oxford University Press, 2008.													
E-RESOURCES:														
1.	https://nptel.ac.in/courses/108108112													
2.	https://nptel.ac.in/courses/117103063													
3.	http://www.electronics-tutorials.ws/													
4.	https://nptel.ac.in/courses/108101091													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to											Mapping POs		Mapping PSOs	
C01	Define and explain BJT and MOSFET circuits, amplifier characteristics, feedback and power amplifiers.										--			
C02	Apply circuit analysis techniques to design and solve problems involving biasing circuits and amplifiers.										PO1, PO3		PSO1	
C03	Analyze frequency response, feedback mechanisms, stability, and performance parameters of electronic circuits using appropriate models and methods.										PO2, PO3		PSO1	
C04	Design and develop analog circuits and adapt to modern tools and emerging technologies for real-world applications.										PO2, PO3, PO5		PSO1	
C05	Demonstrate professional competency by working individually or in teams to communicate, present and justify solutions related to analog electronic circuits.										PO6,PO9, PO10, PO11		PSO1, PSO2, PSO3	
C06	Use simulation tools to analyze the behaviour of analog electronic circuits.										PO5, PO9, PO11		PSO1, PSO2	
The Course Articulation Matrix (CAM) for defined COs:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PSO 1	PSO 2	PSO 3
C01														
C02	3		3									3		
C03		3	3									3		
C04		3	3		3							3		
C05						3			3	3	3	3	3	3
C06					3				3		3	2	2	

Activities:

1. CaseStudy (CO5)/Technical Seminar Presentation (CO5) (Independent study)
2. Simulation-Solution to Analog electronic circuits using software (CO6)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Problem formulation	20	Problem is clearly formulated with correct specifications.	Problem is defined, but some specifications are incomplete	Problem is defined, but specifications are unclear
2.	Circuit design & construction	30	Accurate circuit design and proper construction of network	Correct design with minor errors in construction	Incomplete or incorrect circuit design
3.	Verification & analysis of results	30	Results are correctly verified and well justified using analysis	Results are verified but justification is limited	Results are not properly verified or unclear
4.	Report presentation	20	Report is well structured, clear and professionally presented	Report is structured but needs improvement	Poorly structured report
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Understanding of circuit simulation tools	20	Clearly demonstrates correct use of simulation tools for circuit analysis	Simulation tools used with minor errors	Limited understanding of simulation tools
2.	Simulation setup & circuit modelling	30	Correct circuit modeling with accurate parameters and setup	Minor errors in modeling or parameter selection	Incomplete or incorrect circuit modeling
3.	Analysis of waveforms & results	30	Accurate interpretation of waveforms, frequency response, and results	Results interpreted with minor errors	Poor or unclear interpretation of results
4.	Presentation & communication of results	20	Results are well-organized and clearly presented using graphs and plots	Presentation is acceptable but needs improvement	Poorly structured presentation
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
C01	12	12			12	2
C02	24	24			24	3
C03	12	12			12	2
C04	12	12			12	2
C05			40		20	2
C06				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC302	DIGITAL SYSTEM DESIGN		SEMESTER				III	
Prerequisites			Category	ES(PC)	Credits		4	
1. Basic Computer Knowledge 2. Introductory Digital Concepts			Hours/ Semester	L	T	P	SL	TH
				45	15	45	15	120
COURSE OBJECTIVES								
1.	To understand number systems, binary arithmetic, and Boolean algebra fundamentals.							
2.	To develop skills in simplification and implementation of Boolean functions.							
3.	To design and analyze combinational logic circuits.							
4.	To design and analyze sequential logic circuits using flip-flops, registers, and counters.							
5.	To understand memory devices and programmable logic devices used in digital system design.							
UNIT - I		BOOLEAN ALGEBRA AND NUMBER SYSTEMS						12+9
Boolean Algebra: Number Systems, Binary, Octal, Hexadecimal, Representation of negative numbers, 1's and 2's Complements, Arithmetic Operations, Binary Codes. Boolean Algebra, Theorems and Postulates, Functions, Truth Table, Logic Gates, Universal gates.								
Practical:								
1. Realization of basic logic functions using logic gates								
2.Verification of Boolean identities and implementation of Boolean functions.								
UNIT - II		LOGIC SIMPLIFICATION AND KARNAUGH MAPS						12+9
Canonical and Standard Forms, Minterms and Maxterms, Sum of Products (SOP) and Product of Sums (POS), Conversions and Expansion. Karnaugh Map and Combinational Logic: Simplification of Boolean Functions, using 2,3,4 variable K-Maps, Don't Care Conditions, NAND / NOR Implementations.								
Practical:								
1.Simplification and expansion of standard Boolean functions.								
2. Realization of Boolean functions using NAND and NOR gates.								
3.Implementation of Arithmetic circuits and extended operations.								
UNIT - III		COMBINATIONAL CIRCUITS						12+9
Combinational Logic Design, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Parallel Adder, Carry Look-Ahead Adder, BCD Adder, Binary Multiplier. Magnitude Comparator, Code Converters, Decoder, Encoder, Priority Encoder, Multiplexer and Demultiplexer.								
Practical:								
1. Combinational circuits using code converters.								
2. BCD adder, encoder and decoder circuits.								
3. Design and verification of Encoder, Decoder, Multiplexer and Demultiplexer circuits.								
UNIT - IV		SEQUENTIAL LOGIC DESIGN						12+9
Latches and Flip-Flops: SR Latch, D Latch, SR, JK, T and D Flip-Flops, Master-Slave Flip-Flops, Excitation Tables.Sequential Circuit Analysis and Design, Moore and Mealy Models. Registers: Shift Registers, Universal Shift Registers. Counters: Asynchronous (Ripple) Counters, Synchronous Counters, Ring Counter and Johnson Counter.								
Practical:								
1.Design and implementation of shift registers and counters.								
2.Design of a sequential logic circuit for a practical application.								

UNIT - V		MEMORY DEVICES AND PROGRAMMABLE LOGIC DEVICES		12+9
Classification of memories –RAM organization – ROM organization – Flash Memory - Programmable Logic Devices: Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Implementation of combinational logic using ROM, PAL and PLA.				
Practical:				
1. Implementation of logic functions using programmable logic devices or simulation tools.				
2. Mini project on the design of a digital circuit for solving practical problems.				
L:45, T:15, P:45, SL:15, Total:120 Hours				
Weightage:				
Continuous Assessment 50%				
End Semester Examinations 50%				
TEXT BOOKS:				
1.	M. Morris Mano, "Digital Design", 4th Edition, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2008.			
2.	R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th Edition, 2009			
REFERENCE BOOKS:				
1.	W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, ,2006.			
2.	D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989			
3.	S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 2nd edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2004.			
E-RESOURCES:				
1.	http://nptel.ac.in/noc/individual_course.php?id=noc15-ec01			
2.	https://nptel.ac.in/courses/117105080/6			
3.	https://nptel.ac.in/courses/117105080/12			
4.	https://mrcet.com/downloads/digital_notes/IT/DIGITAL%20LOGIC%20DESIGN%20(R17A0461).pdf			
5.	https://www.msajce-edu.in/academics/ece/2021/LectureNote/EC3352-LN.pdf			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Apply number systems, binary arithmetic operations, and Boolean algebra principles in digital systems.		PO1, PO2	PSO1,PSO2
CO2	Simplify and implement Boolean functions using Karnaugh maps and universal gates.		PO1, PO2, PO4	PSO1,PSO2, PSO3
CO3	Design and analyze combinational logic circuits for digital applications.		PO1, PO2, PO3, PO5	PSO2,PSO3
CO4	Design and analyze sequential logic circuits using flip-flops, registers, and counters.		PO1, PO2, PO4, PO5	PSO1,PSO2, PSO3
CO5	Analyze memory organizations and implement digital systems using programmable logic devices.		PO1, PO2, PO3, PO4, PO5, PO9	PSO1,PSO2, PSO3
CO6	Develop and demonstrate a digital system solution for a practical engineering problem using simulation or hardware implementation.		PO1, PO2, PO3, PO5, PO9, PO10, PO11	PSO1,PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	1	2	–
CO2	2	3	2	1	2	–	–	–	–	–	–	3	2	–
CO3	3	2	3	2	2	–	–	–	–	–	–	2	3	1
CO4	3	2	1	2	2	–	–	–	–	–	–	2	3	1
CO5	2	2	2	2	3	–	–	–	–	–	–	3	1	2
CO6	2	2	3	3	3	–	–	–	2	2	1	1	3	2

Activities:

1.	Implement combinational logic using ROM, PAL, or PLA through simulation.
2.	Traffic Light Controller using Sequential Logic.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Problem Understanding & Truth Table Design	20	Correctly derives complete truth table and logic requirements without errors	Minor errors in truth table or interpretation	Partial understanding; some missing inputs/outputs
2.	K-Map / Boolean Function Derivation	30	Accurate minimization using K-map or Boolean algebra	Minor simplification errors	Basic function derived but not optimized
3.	ROM / PAL / PLA Design Mapping	25	Correct mapping of inputs, outputs, and memory/array structure	Minor mapping errors	Partial mapping of logic
4.	Circuit Implementation (Simulation)	15	Fully working simulation with correct outputs for all cases	Minor simulation issues	Partial working circuit
5.	Test Case Verification	10	All input combinations tested and verified correctly	Few cases not verified	Limited test cases checked
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Circuit Implementation (Simulation)	20	Fully working simulation with correct timing and transitions	Minor timing or output issues	Partially working circuit
2.	Timing Sequence & Signal Operation	20	Correct and smooth sequence of traffic signals with proper timing	Minor timing mismatch	Basic sequence with some errors
3.	Test Case Verification	20	All states tested and validated correctly	Few cases not verified	Limited verification
4.	Observation & Result Analysis	20	Clear explanation of working with proper justification	Good explanation with minor gaps	Basic explanation
5.	Documentation & Presentation	20	Well-structured report with neat diagrams and labels	Good documentation with minor issues	Basic documentation
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Theory Component				Laboratory Component		Percentage allocation	Mapping Strength
	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
CO1	12	12					6	1
CO2	24	24			70	70	47	3
CO3	12	12			20	20	16	2
CO4	12	12			10	10	11	2
CO5			40				10	2
CO6				40			10	2
Total	60	60	40	40	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC303	NETWORK THEORY AND SYNTHESIS		SEMESTER				III
Prerequisites		Category	ES(PC)	Credits			3
1. Basic Electrical Engineering 2. Engineering Mathematics		Hours/ Semester	L	T	P	SL	TH
		45	0	0	45	90	
COURSE OBJECTIVES							
1.	To learn basic circuit analysis methods and network theorems.						
2.	To understand transient response and analyze circuits using the s-domain.						
3.	To study the working of magnetic resonance circuits and their applications.						
4.	To learn the analysis and representation of two-port networks.						
5.	To understand passive network synthesis and realization of electrical networks.						
UNIT - I	NETWORK ANALYSIS TECHNIQUES AND THEOREMS						9
Revision of Mesh and Nodal Analysis – Comparison of Node and Mesh Analysis – Delta – Wye Transformation – Source Transformation and Duality – Network theorems (for both DC and AC circuits): Superposition – Thevenin's – Norton's – Maximum Power Transfer theorem.							
UNIT - II	TRANSIENT ANALYSIS AND CIRCUIT ANALYSIS IN s – DOMAIN						9
Transient study in RL, RC, and RLC networks: Response to Step, Impulse and Sinusoidal inputs – Concept of Complex frequency: Driving points and Transfer Functions – Poles and zeros of Admittance function – Properties – Sinusoidal response from pole-zero locations.							
UNIT - III	MAGNETIC RESONANCE CIRCUITS						9
Series and parallel resonance: Variation of impedance with frequency – Bandwidth of RLC circuit – Q factor – Impedance of RLC circuit near resonance – Selectivity – Magnification – Self - inductance – Mutual inductance – Coefficient of coupling – Dot convention – Analysis of multi - winding coupled circuits – Ideal transformer.							
UNIT - IV	TWO PORT NETWORKS AND FILTERS						9
One port and Two port networks – Z parameters – Y parameters – h parameters – ABCD parameters – Filters: Classification of filters – Characteristics of filters.							
UNIT - V	PASSIVE NETWORK SYNTHESIS						9
Elements of Realizability Theory: Stability – Hurwitz Polynomials – Positive Real Functions: Definition – Necessary and sufficient conditions for a function to be positive real – Elements of circuit synthesis: Foster and Cauer forms of LC Networks – Synthesis of RC and RL networks.							
L:45, SL:45, Total: 90 Hours							
Weightage:							
Continuous Assessment 40%							
End Semester Examinations 60%							

TEXT BOOKS:														
1.	Ravish R Singh, "Network analysis and Synthesis", 2 nd edition, McGraw Hill Education, 2019.													
2.	A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", 6 th edition, McGraw Hill Education, 2025.													
REFERENCE BOOKS:														
1.	S.K. Bhattacharya and Manpteet Singh, "Network analysis and Synthesis", 1 st edition, Pearson Publication, 2015.													
2.	Abhijit Chakrabarthy, "Circuit Theory Analysis and Synthesis", Dhanpath Rai & Sons, NewDelhi, 2023.													
3.	William H. Hayt, Jack E. Kemmerly, and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill Education, 2024.													
E-RESOURCES:														
1.	https://www.electrical4u.com/network-theory/?utm_source=chatgpt.com													
2.	https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/?utm_source=chatgpt.com													
3.	https://nptel.ac.in/courses/108102042/													
4.	https://nptel.ac.in/courses/106105154/2													
5.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/lecture-2/													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to											Mapping POs		Mapping PSOs	
C01	Understand the basic concepts and fundamental principles of electrical network analysis and their applications.										--		PSO1, PSO2	
C02	Analyze electrical circuits using various theorems, transient response, resonance, two-port networks, and synthesis concepts.										PO1		PSO1, PSO2	
C03	Solve circuit problems involving network theorems, transient analysis, resonance, coupling, and network synthesis across all topics.										PO2, PO3		PSO1, PSO2	
C04	Compare and evaluate different circuit analysis techniques such as s-domain analysis, resonance, two-port parameters, and synthesis methods.										PO5		PSO1, PSO2, PSO3	
C05	Design and construct electrical networks by applying passive network synthesis techniques, solving and verifying circuit configurations using analytical methods across different network types.										PO6, PO9, PO10, PO11		PSO1, PSO2, PSO3	
C06	Use simulation tools to analyze electrical circuits and present results using graphs and waveforms.										PO6, PO9, PO10, PO11		PSO1, PSO2, PSO3	
The Course Articulation Matrix (CAM) for defined COs:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01												3	2	
C02	3											3	2	
C03		3	3									3	2	
C04					3							2	3	1
C05						3			2	2	2	3	3	2
C06						3			2	2	2	2	3	2

Activities:

1. Using suitable simulation software, design an electrical network using **passive network synthesis techniques (Foster or Cauer method)**. Construct the equivalent circuit and verify its correctness using analytical methods. Analyze the circuit response and validate the results obtained from the simulation. Prepare a detailed report explaining the synthesis method, circuit design, and verification results.
2. Using suitable circuit simulation tools, design and simulate an electrical circuit and analyze its performance. Perform the circuit modeling, generate waveforms and graphs, and interpret the results such as time-domain and frequency-domain responses. Clearly present and communicate the simulation outcomes using proper plots and explanations in a technical seminar presentation.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Problem formulation & network specification	20	Problem is clearly formulated with correct specifications and boundary conditions	Problem is defined, but some specifications/boundary conditions are incomplete	Problem is defined, but specifications and boundary conditions are unclear
2.	Application of passive network synthesis technique	30	Correctly applies Foster/Cauer synthesis methods to design the network	Applies correct method with minor errors in steps	Attempts synthesis but with major errors or incomplete procedure
3.	Circuit design & construction	25	Accurate circuit design and proper construction of network	Correct design with minor errors in construction	Incomplete or incorrect circuit design
4.	Verification & analysis of results	15	Results are correctly verified and well justified using analysis	Results are verified but justification is limited	Results are not properly verified or unclear
5.	Report presentation	10	Report is well structured, clear and professionally presented	Report is structured but needs improvement	Poorly structured report
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Understanding of circuit simulation tools	20	Clearly demonstrates correct use of simulation tools for circuit analysis	Simulation tools used with minor errors	Limited understanding of simulation tools

2.	Simulation setup & circuit modelling	30	Correct circuit modeling with accurate parameters and setup	Minor errors in modeling or parameter selection	Incomplete or incorrect circuit modeling
3.	Analysis of waveforms & results	30	Accurate interpretation of waveforms, frequency response, and results	Results interpreted with minor errors	Poor or unclear interpretation of results
4.	Presentation & communication of results	20	Results are well-organized and clearly presented using graphs and plots	Presentation is acceptable but needs improvement	Poorly structured presentation
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12			12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC304	SIGNALS AND SYSTEMS		SEMESTER				III
Prerequisites		Category	ES(PC)	Credits			4
NIL		Hours/ Semester	L	T	P	SL	TH
			45	15	0	60	120
COURSE OBJECTIVES							
1.	To understand the fundamental concepts, classifications, properties and mathematical representations of continuous-time and discrete-time signals and systems.						
2.	To apply convolution, correlation, Fourier Series and Fourier Transform techniques for time-domain and frequency-domain analysis of signals and systems.						
3.	To analyze continuous-time and discrete-time systems using Laplace Transform, Z-Transform and sampling theory for system characterization and signal reconstruction.						
4.	To solve engineering problems involving spectral analysis, system realization and signal processing applications using analytical and computational techniques.						
5.	To employ modern engineering tools, self-learning practices, ethical principles, teamwork and effective communication for investigating and presenting signals and systems applications in communication, biomedical, multimedia and intelligent systems.						
UNIT - I	INTRODUCTION TO SIGNALS AND SYSTEMS						12
Classification of Signals – Even and Odd Signals – Energy and Power Signals – Continuous-Time (CT) and Discrete-Time (DT) Signals – Continuous and Discrete Amplitude Signals – System Properties and Representation: Linearity, Time Invariance, Causality, Stability and Realizability – Linear Time-Invariant (LTI) Systems – Impulse Response and Step Response – Convolution – Correlation – System Representation using Differential Equations and Difference Equations.							
UNIT - II	FOURIER ANALYSIS OF CONTINUOUS-TIME SIGNALS						12
Continuous Time Fourier Series (CTFS) – Properties of CTFS – Continuous Time Fourier Transform (CTFT) – CTFT of Continuous-Time Periodic Signals – Properties of CTFT – Frequency Response of Systems Characterized by Differential Equations – Spectrum Analysis and Engineering Applications.							
UNIT - III	LAPLACE TRANSFORM AND CONTINUOUS-TIME LTI SYSTEMS						12
Laplace Transform – Laplace Transforms of Common Signals – Region of Convergence (ROC) – Properties of Laplace Transform – Inverse Laplace Transform – System Function – Unilateral Laplace Transform – Solving Differential Equations using Laplace Transform – Pole-Zero Representation and Stability Analysis of Continuous-Time Systems.							
UNIT - IV	SAMPLING THEOREM AND Z-TRANSFORMS						12
Representation of Continuous-Time Signals by Samples – Sampling Theorem – Nyquist Rate of Sampling – Effects of Under Sampling (Aliasing) – Sampling Techniques – Data Reconstruction – Sampling of Band-Pass Signals – Z-Transform – Relationship between Z-Transform and Fourier Transform – Region of Convergence – Properties of ROC – Properties of Z-Transform – Poles and Zeros – Inverse Z-Transform.							
UNIT - V	FOURIER ANALYSIS OF DISCRETE-TIME SIGNALS						12
Discrete Time Fourier Series (DTFS) – Properties of DTFS – Discrete Time Fourier Transform (DTFT) – Properties of DTFT – Frequency Response of Discrete-Time LTI Systems – Discrete Fourier Transform (DFT) – Realization Structures: Direct Form-I, Direct Form-II, Cascade Form and Parallel Form.							
L:45, T:15, SL:60, Total:120 Hours							

Weightage:

Continuous Assessment 40%

End Semester Examinations 60%

TEXT BOOKS:

- | | |
|----|---|
| 1. | B. P. Lathi, <i>Principles of Signal Processing and Linear Systems</i> , Oxford University Press, 2009. |
| 2. | V. Krishnaveni and A. Rajeswari, <i>Signals and Systems</i> , 1st Edition, Wiley India Pvt. Ltd., 2012. |

REFERENCE BOOKS:

- | | |
|----|---|
| 1. | Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, <i>Signals and Systems</i> , 2nd Edition, PHI Learning Private Limited, New Delhi, 2010. |
| 2. | Simon Haykin and Barry Van Veen, <i>Signals and Systems</i> , John Wiley and Sons (Asia) Private Limited, 1998. |
| 3. | Michael J. Roberts, <i>Signals and Systems: Analysis using Transform Methods and MATLAB</i> , McGraw Hill Education. |

E-RESOURCES:

- | | |
|----|---|
| 1. | https://nptel.ac.in/courses/117104074 |
| 2. | https://ocw.mit.edu |
| 3. | https://www.mathworks.com/products/signal.html |
| 4. | https://docs.scipy.org |
| 5. | https://octave.sourceforge.io |

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

CO1	Explain the fundamental concepts, classifications, properties and mathematical representations of continuous-time and discrete-time signals and systems.	PO1	PSO1, PSO2
CO2	Apply convolution, correlation, Fourier analysis, Laplace Transform and Z-Transform techniques to represent and analyze signals and systems in time and frequency domains.	PO1, PO2	PSO1, PSO2
CO3	Analyze the behavior, stability and frequency response of continuous-time and discrete-time systems using appropriate transform-domain techniques.	PO2	PSO1, PSO2
CO4	Solve engineering problems involving signal sampling, reconstruction, spectral analysis and realization of continuous-time and discrete-time systems.	PO2, PO3	PSO1, PSO2
CO5	Use modern engineering tools, self-learning strategies and interdisciplinary knowledge to investigate applications of signals and systems in communication, biomedical, multimedia, control and intelligent systems while evaluating societal, economic and sustainability impacts.	PO4, PO5, PO6, PO7, PO10, PO12	PSO1, PSO2, PSO 3
CO6	Demonstrate ethical practices, teamwork, project planning and professional communication while solving, simulating and presenting signals and systems problems using computational tools.	PO5, PO8, PO9, PO10, PO11, PO12	PSO1, PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	-	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	-	3	3	-	-	-	-	-	-	-	-	-	2	3
CO5	-	-	-	3	3	3	2	-	-	3	-	3	2	2
CO6	-	-	-	-	3	-	-	3	3	3	2	3	2	2

Activities:

1.	Study the use of Signals and Systems in - Wireless Communication Systems - Biomedical Signal Processing - Audio and Speech Processing - Image and Video Processing - AI-Assisted Signal Analytics Analyse societal benefits, economic feasibility and sustainability aspects.
2.	Solve and simulate Signals and Systems problems involving convolution, correlation, Fourier Transform, Laplace Transform, Z-Transform and Sampling Theorem using MATLAB/Python/Scilab and present the results through reports, seminars or technical presentations.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Technical Investigation and Analysis	20	Provides comprehensive technical analysis using Signals and Systems concepts.	Provides adequate analysis with minor gaps.	Provides limited analysis with several gaps.
2.	Application Relevance and Innovation	20	Clearly identifies innovative and interdisciplinary applications.	Identifies relevant applications with moderate depth.	Limited application relevance.
3.	Societal, Economic and Sustainability Evaluation	20	Thoroughly evaluates societal impact, feasibility and sustainability.	Adequately discusses major aspects.	Limited discussion of impacts.
4.	Research Quality and Use of References	20	Uses multiple high-quality references with proper organization.	Uses relevant references with proper citation.	Uses limited references.
5.	Presentation and Communication Skills	20	Professional, well-structured and highly effective communication.	Clear presentation with minor deficiencies.	Adequate presentation lacking clarity.
	Total	100			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Technical Investigation and Analysis	20	Provides comprehensive technical analysis using Signals and Systems concepts.	Provides adequate analysis with minor gaps.	Provides limited analysis with several gaps.
2.	Application Relevance and Innovation	20	Clearly identifies innovative and interdisciplinary applications.	Identifies relevant applications with moderate depth.	Limited application relevance.
3.	Societal, Economic and Sustainability Evaluation	20	Thoroughly evaluates societal impact, feasibility and sustainability.	Adequately discusses major aspects.	Limited discussion of impacts.
4.	Research Quality and Use of References	20	Uses multiple high-quality references with proper organization.	Uses relevant references with proper citation.	Uses limited references.
5.	Presentation and Communication Skills	20	Professional, well-structured and highly effective communication.	Clear presentation with minor deficiencies.	Adequate presentation lacking clarity.
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
C01	12	12			12	2
C02	24	24			24	3
C03	12	12			12	2
C04	12	12			12	2
C05			40		20	2
C06				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC305		PROBLEM SOLVING USING PYTHON		SEMESTER				III	
Prerequisites			Category	ES(PC)	Credits			4	
1. Basic Computer Fundamentals			Hours/ Semester	L	T	P	SL	TH	
				45	15	45	15	120	
COURSE OBJECTIVES									
1. To develop computational thinking and algorithmic problem-solving skills using Python programming.									
2. To apply Python data types, expressions, operators and control structures for solving engineering problems.									
3. To design modular programs using functions, strings and recursive techniques.									
4. To implement data processing applications using Python collections, file handling and software packages.									
5. To utilize modern Python development tools to develop, test and document solutions while considering ethical, societal and professional practices.									
UNIT - I		COMPUTATIONAL THINKING AND PROBLEM SOLVING						12+9	
Fundamentals of Computing – Identification of Computational Problems – Algorithms – Building Blocks of Algorithms (Sequence, Selection and Iteration) – Pseudocode – Flowcharts – Algorithmic Problem Solving – Problem Decomposition – Recursion Concepts – Computational Thinking for Engineering Applications.									
Practical Component									
1. Development of algorithms and flowcharts for real-world engineering problems.									
2. Implementation of computational thinking exercises including number guessing, Towers of Hanoi and sorting problems.									
3. Problem decomposition and algorithm design activities.									
UNIT - II		DATA TYPES, EXPRESSIONS AND STATEMENTS						12+9	
Python Interpreter – Interactive Mode – Variables – Constants – Data Types – Type Conversion – Operators – Expressions – Input and Output Statements – Assignment Statements – Operator Precedence – Comments and Documentation.									
Practical Component									
1. Programs using arithmetic, relational and logical operators.									
2. Engineering applications involving unit conversion and formula evaluation.									
3. Programs for swapping values, distance calculations and scientific computations.									
UNIT - III		CONTROL FLOW, FUNCTIONS AND STRINGS						12+9	
Conditional Statements – Nested Conditions – Loops – Break and Continue – Functions – Parameter Passing – Scope Rules – Recursion – Strings – String Operations – String Methods – Pattern Matching.									
Practical Component									
1. Programs using conditional and iterative constructs.									
2. Function-based engineering applications.									
3. String processing applications including palindrome checking, text analytics and pattern generation.									
UNIT - IV		LISTS, TUPLES, DICTIONARIES AND SETS						12+9	
Lists – List Operations – Slicing – Comprehensions – Tuples – Dictionaries – Sets – Data Organization – Data Processing Applications – Searching and Sorting Techniques.									
Practical Component									
1. Student database management using dictionaries.									
2. Data analysis using lists and tuples.									
3. Inventory and billing applications using Python collections.									

UNIT - V	FILES, MODULES, PACKAGES AND APPLICATION DEVELOPMENT	12+9	
Files – Reading and Writing Files – Exception Handling – Modules – Packages – Python Libraries – Introduction to NumPy, Pandas and Matplotlib – Software Development Practices – Documentation and Testing.			
Practical Component			
1. File processing applications.			
2. Exception handling programs.			
3. Mini application development using Python libraries.			
4. Data visualization using Matplotlib.			
L:45, T:15, P:45, SL:15, Total:120 Hours			
Weightage:			
Continuous Assessment 50%			
End Semester Examinations 50%			
TEXT BOOKS:			
1.	Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly, 2016.		
2.	Karl Beecher, Computational Thinking: A Beginner's Guide to Problem Solving and Programming, BCS Learning & Development Ltd., 2017.		
REFERENCE BOOKS:			
1.	Paul Deitel and Harvey Deitel, Python for Programmers, Pearson, 2021.		
2.	G. Venkatesh and Madhavan Mukund, Computational Thinking: A Primer for Programmers and Data Scientists, Notion Press, 2021.		
3.	John V. Guttag, Introduction to Computation and Programming Using Python, MIT Press, 2021.		
E-RESOURCES:			
1.	https://docs.python.org/3/		
2.	https://nptel.ac.in/courses/106106145		
3.	https://pypi.org		
4.	https://numpy.org/doc		
5.	https://matplotlib.org/stable/users		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Explain computational thinking principles, algorithms, programming constructs and data representation techniques used in Python programming.	PO1	PSO1
CO2	Apply Python programming concepts including control structures, functions, strings, data structures and file handling to solve computational and engineering problems.	PO1,PO2	PSO1, PSO2
CO3	Develop modular Python programs for engineering and real-world applications using appropriate problem-solving methodologies.	PO2, PO3	PSO1, PSO2
CO4	Analyze, test and optimize Python solutions using debugging techniques, software libraries and modern development tools.	PO4, PO5	PSO2
CO5	Evaluate Python-based solutions for engineering, data analytics and societal applications considering efficiency, usability and professional communication through case studies and presentations.	PO5, PO6, PO9	PSO2, PSO3
CO6	Develop Python projects collaboratively using ethical practices, self-learning strategies, project planning skills and technical documentation.	PO7, PO8, PO9, PO10, PO11	PSO3

The Course Articulation Matrix (CAM) for defined COs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	2	-
CO3	-	3	3	-	-	-	-	-	-	-	-	2	3	-
CO4	-	-	-	3	3	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	3	-	-	3	-	-	-	2	3
CO6	-	-	-	-	-	-	3	3	3	2	3	-	-	3

Activities:

1.	Performance Analysis of Refrigeration and Air-Conditioning Systems Using Modern Engineering Tools (CO4) Examples: • Program debugging and testing • Data visualization using Python libraries • Performance comparison of alternative algorithms Small engineering data analysis tasks
2.	Case Study - Evaluation of Thermodynamic System (Thermal/ Gas Turbine/ Solar/ Combined Cycle Power Plant, HVAC System). Considering Economic, Safety and Environmental Aspects. (CO5 & CO6) Examples: • Student Result Analysis System • Library Management System • Personal Expense Tracker • Attendance Management System • Weather Data Analysis Smart Campus Utility Applications

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Program Design and Logic	30	Efficient solution with correct logic and modular design	Minor logical issues	Basic solution with guidance
2.	Use of Python Tools and Libraries	25	Effective use of tools and libraries	Adequate use with minor issues	Limited usage
3.	Debugging and Testing	20	Thorough testing and validation	Partial testing	Minimal testing
4.	Code Quality and Documentation	10	Well-documented and readable code	Adequate documentation	Poor documentation
5.	Presentation and Communication	15	Excellent presentation and explanation	Good presentation	Limited explanation
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Problem Analysis and Solution Design	30	Comprehensive analysis and effective solution	Adequate analysis	Basic solution
2.	Software Development and Implementation	25	Efficient and fully functional implementation	Minor issues	Partially functional
3.	Self-Learning and Resource Utilization	15	Extensive use of learning resources	Moderate use	Limited use
4.	Teamwork and Participation	10	Excellent collaboration	Moderate participation	Limited participation
5.	Report Presentation and Documentation	20	Professional report and presentation	Adequate presentation	Poor organization
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Theory Component				Laboratory Component		Percentage allocation	Mapping Strength
	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
CO1	12	12					6	1
CO2	24	24			70	70	47	3
CO3	12	12			20	20	16	2
CO4	12	12			10	10	11	2
CO5			40				10	2
CO6				40			10	2
Total	60	60	40	40	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC306		ANALOG CIRCUITS - I LABORATORY		SEMESTER				III	
Prerequisites			Category	ES(PC)	Credits			2	
			Hours/ Semester	L	T	P	SL	TH	
				0	0	45	15	60	
COURSE OBJECTIVES									
1.	Understand and analyze BJT and MOSFET biasing circuits and their operating points.								
2.	Construct and test BJT amplifiers (CE, CB, and CC) and MOSFET amplifiers (CS, CG, and CD).								
3.	Measure and evaluate amplifier characteristics such as voltage gain, input/output signals, and frequency response.								
4.	Construct and analyze differential amplifiers, Class-B push-pull power amplifiers, and negative feedback amplifiers.								
5.	Develop practical skills in assembling, testing, troubleshooting, and interpreting the performance of analog electronic circuits using electronic laboratory instruments.								
EXPERIMENTS									
1.	Analyze BJT biasing circuits using DC Load-Line method.								
2.	Implement and analyze MOSFET biasing circuits.								
3.	Measure the frequency response of Common Emitter (CE) amplifier.								
4.	Measure the frequency response of Common Source (CS) amplifier.								
5.	Measure the frequency response of multistage amplifier.								
6.	Construct a differential amplifier and measure CMRR.								
7.	Construct and evaluate the efficiency of a Class-A Power amplifier.								
8.	Construct and evaluate the efficiency of a Class-B push-pull Power amplifier.								
9.	Analyze the Performance of a voltage series and shunt feedback amplifier.								
10.	Analyze the Performance of a current series and shunt feedback amplifier.								
P:45, SL:15, Total:60 Hours									
Weightage: Continuous Assessment 60% End Semester Examinations 40%									
TEXT BOOKS:									
1.	A.S. Sedra and K.C. Smith, Microelectronic Circuits, 8 th edition, Oxford University Press, 2020.								
2.	S. Salivahanan and N. Suresh kumar, "Electronic Devices and Circuits", 5e, McGraw Hill Education, 2022.								
REFERENCE BOOKS:									
1.	Donald A. Neamen. "Semiconductor Physics and Devices" 4 th Edition, McGraw Hill Education 2021.								
2.	Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" 11 th edition, PHI, 2017.								
3.	Ben G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2015.								

E-RESOURCES:

1.	https://nptel.ac.in/courses/108108112
2.	https://nptel.ac.in/courses/117103063
3.	http://www.electronics-tutorials.ws/
4.	https://nptel.ac.in/courses/108101091
5.	https://www.circuitlab.com?utm_source=chatgpt.com

COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Understand the basic concepts of BJT and MOSFET biasing circuits, amplifier configurations, differential amplifiers, power amplifiers, and feedback amplifiers.	PO1, PO2	PSO1, PSO2
CO2	Apply the principles of BJT and MOSFET biasing, amplifier configurations, differential amplifiers, power amplifiers, and feedback amplifiers to perform practical experiments.	PO1, PO2, PO3, PO5	PSO1, PSO2
CO3	Analyze the characteristics and performance of BJT bias circuits, MOSFET bias circuits, amplifier frequency responses, differential amplifiers, Class-B push-pull amplifiers, and feedback amplifiers.	PO1, PO2, PO4, PO5	PSO1, PSO2, PSO3
CO4	Evaluate the performance parameters of transistor circuits, including operating point, voltage gain, bandwidth, frequency response, CMRR, efficiency, and feedback effects.	PO1, PO2, PO4, PO5, PO11	PSO1, PSO2, PSO3
CO5	Perform practical activities to design, construct, test, and troubleshoot electronic circuits using appropriate components and measuring instruments.	PO1, PO2, PO3, PO5, PO9, PO10	PSO1, PSO2, PSO3
CO6	Develop practical skills through experimental activities to compare different amplifier configurations and interpret measured results for improving circuit performance.	PO1, PO2, PO3, PO5, PO9, PO10	PSO1, PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	3	2	–
CO2	2	3	3	–	2	–	–	–	–	–	–	3	2	–
CO3	2	3	–	3	2	–	–	–	–	–	2	2	3	1
CO4	2	3	3	2	2	–	–	–	–	–	–	2	3	1
CO5	1	2	2	–	2	–	–	–	3	3	1	1	2	2
CO6	1	2	2	–	2	–	–	–	3	3	1	1	2	2

Activities:

1. Design a 5V/12V regulated power supply using rectifier, filter, and Zener regulator.
2. Design a transistor-based audio amplifier.

Rubrics for evaluation: CO5

Sl. No.	Criteria	Marks	Excellent (5)	Good (4)	Satisfactory (3)
1.	Circuit Design	20	Correct selection and design of transformer, rectifier, filter, and Zener regulator with proper calculations.	Minor errors in calculations or component selection.	Basic design completed with some guidance.
2.	Circuit Implementation	20	Circuit assembled accurately with proper wiring and safety practices.	Minor wiring mistakes corrected independently.	Circuit works with instructor assistance.
3.	Testing and Measurement	20	Accurate measurement of input/output voltage, ripple factor, and regulation characteristics.	Measurements mostly accurate with minor deviations.	Basic measurements performed correctly.
4.	Analysis and Interpretation	20	Thorough analysis of rectifier, filter, and regulator performance; results compared with theory.	Good analysis with minor omissions.	Basic comparison with theoretical values.
5.	Documentation and Presentation	20	Well-organized report with circuit diagram, calculations, observations, results, and conclusions.	Report complete with minor deficiencies.	Report contains essential details only.
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criteria	Marks	Excellent (5)	Good (4)	Satisfactory (3)
1.	Circuit Design and Component Selection	20	Correct amplifier design with appropriate biasing, gain calculations, and component selection.	Minor errors in calculations or component values.	Basic design completed with guidance.
2.	Circuit Construction and Implementation	20	Circuit assembled accurately with proper wiring and troubleshooting skills.	Minor wiring errors corrected independently.	Circuit functions with assistance.
3.	Performance Testing and Measurements	20	Accurate measurement of voltage gain, input/output waveforms, and frequency response.	Most measurements accurate with minor deviations.	Basic measurements completed correctly.

4.	Analysis and Interpretation of Results	20	Comprehensive analysis of amplifier performance and comparison with theoretical values.	Good analysis with minor omissions.	Basic interpretation of results.
5.	Technical Report and Presentation	20	Well-structured report including design calculations, circuit diagram, observations, results, and conclusions.	Report complete with minor deficiencies.	Report contains essential information only.
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Laboratory Component		Percentage allocation	Mapping Strength
	Evaluation of Student Work, Observation of Record and Model Test	Activities		
CO1	20	20	20	2
CO2	20	20	20	2
CO3	20	20	20	2
CO4	20	20	20	2
CO5	10	10	10	2
CO6	10	10	10	2
Total	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26MCC03	UNIVERSAL HUMAN VALUES B.E. (Common to All Branches)		SEMESTER				III
Prerequisites		Category	MC	Credits			3
Basic awareness of human values, personal behaviour, family relationships, social responsibility, and ethical conduct in daily life. Familiarity with the ideas of self-reflection, harmony, happiness, prosperity, and responsible living will be helpful.		Hours/ Semester	L	T	P	SL	TH
			45	0	0	45	90
COURSE OBJECTIVES							
1.	To understand the need, purpose, basic guidelines, content, and process of value education through self-exploration and natural acceptance.						
2.	To develop awareness of continuous happiness, prosperity, right understanding, relationship, and physical facility as the basic human aspirations.						
3.	To understand harmony in the human being by studying the co-existence of the sentient 'I' and the material 'Body', along with Sanyam, health, and prosperity.						
4.	To understand harmony in family and society through human relationships, trust, respect, justice, fearlessness, prosperity, and universal harmonious order.						
5.	To realize harmony in nature and existence and apply holistic understanding of human values to professional ethics, ethical human conduct, sustainable development, and responsible professional practice.						
UNIT - I	Introduction to Universal Human Values and Human Aspirations						9
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education. Purpose and motivation for the course, recapitulation from Universal Human Values-I. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfil the above human aspirations- understanding and living in harmony at various levels.							
UNIT - II	Harmony in the Human Being: Self and Body						9
Understanding Harmony in the Human Being - Harmony in Myself! Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Health.							
UNIT - III	Harmony in Family and Society: Human Relationships and Social Order						9
Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship Understanding values in human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society Undivided Society, Universal Order- from family to world family.							

UNIT - IV	Harmony in Nature and Existence	9	
Understanding Harmony in the Nature and Existence - Whole existence as Coexistence. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space. Holistic perception of harmony at all levels of existence.			
UNIT - V	Professional Ethics and Universal Human Order	9	
Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics, Strategy for transition from the present state to Universal Human Order.			
L:45, SL:45, Total:90 Hours			
Weightage: Continuous Assessment: 40% End Semester Examinations: 60%			
REFERENCE BOOKS:			
1.	"Human Values and Professional Ethics", R R Gaur., R Sangal., G P Bagaria, Excel Books, New Delhi, 2010		
2.	"Human Values", A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.		
3.	"The Story of Stuff"., Annie Leonard, 2007 documentary.		
4.	"The Story of My Experiments with Truth"., Mohandas Karamchand Gandhi		
5.	"Small is Beautiful" - E. F Schumacher.		
E-RESOURCES:			
1.	AICTE, "Universal Human Values," All India Council for Technical Education, https://www.aicte.gov.in/bureaus/universal-human-values-cell		
2.	UHV Foundation, "Universal Human Values and Professional Ethics," https://uhv.org.in		
3.	Value Education Cell, "Universal Human Values Resources," https://fdp-si.aicte-india.org		
4.	SWAYAM, "Human Values and Professional Ethics," Ministry of Education, Government of India, https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg125		
5.	Universal Human Values Foundation https://uhv.org.in/		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Remember and understand the basic concepts, purpose, need, process, and guidelines of value education, including self-exploration, natural acceptance, continuous happiness, prosperity, right understanding, relationship, and physical facility.	--	--
CO2	Apply the principles of self-exploration, natural acceptance, right understanding, relationship, and physical facility to assess human aspirations and improve harmony in personal life.	PO6	--
CO3	Analyse harmony in the human being by understanding the co-existence of the sentient 'I' and the material 'Body', the needs of self and body, Sanyam, health, and prosperity.	PO7	--

C04	Examine harmony in family and society by understanding values in human relationships, justice, trust, respect, fearlessness, prosperity, co-existence, and universal harmonious order.	PO8	--
C05	Evaluate harmony in nature and existence by understanding interconnectedness, mutual fulfilment, recyclability, self-regulation, and holistic perception of coexistence at all levels.	PO6	--
C06	Integrate holistic understanding of human values, harmony, and ethical conduct to professional practice by considering societal needs, responsible decision-making, and sustainable human development.	PO11	--

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01														
C02						2								
C03							2							
C04								1						
C05						3								
C06											3			
Avg						2.5	2	1			3			

Activities:

1.	Students shall prepare a short reflective assignment on harmony in nature, interconnectedness, mutual fulfilment, recyclability, self-regulation, and coexistence at different levels of existence. This activity helps students understand the importance of sustainable living and holistic harmony.
2.	Students shall analyse a real-life case study related to professional ethics, responsible decision-making, societal needs, or sustainable human development. This activity develops the ability to apply human values, ethical conduct, and holistic understanding in professional and social life.

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (9-10)	Good (6-8)	Satisfactory (1-5)
1.	Understanding harmony in nature	10	Clearly explains harmony, interconnectedness, and mutual fulfilment in nature	Explains the concept with minor gaps	Shows limited understanding
2.	Reflection on coexistence	10	Provides meaningful reflection on coexistence, recyclability, and self-regulation	Reflection is relevant but needs more depth	Reflection is basic or unclear
3.	Practical relevance	10	Relates harmony in nature to sustainable living and human responsibility effectively	Relates the concept with limited examples	Practical relevance is weak
4.	Presentation of assignment	10	Assignment is well-organized, clear, and neatly presented	Assignment is organized but needs improvement	Assignment is incomplete or poorly presented
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (9-10)	Good (6-8)	Satisfactory (1-5)
1.	Selection of ethical case study	10	Suitable case study is selected with clear ethical relevance	Case study is relevant but needs minor clarity	Case study selection is basic or unclear
2.	Application of human values	10	Human values and ethical principles are applied effectively	Values are applied with minor gaps	Application of values is weak
3.	Responsible decision-making	10	Provides clear, responsible, and sustainable decision-making approach	Decision-making is acceptable but needs improvement	Decision-making is unclear or incomplete
4.	Report writing and conclusion	10	Report is well-structured with clear conclusion	Report is organized but needs improvement	Report is incomplete or poorly structured
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12			12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);

Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26MCS02		INNOVATION SPRINTS		SEMESTER			III
Prerequisites			Category	SD	Credits		0
			Hours/ Semester	L	T	P	SL
				0	0	15	15
COURSE OBJECTIVES							
1.	To understand the fundamentals of Design thinking and apply in ideating solutions for real world problems.						
2.	To solve challenges through problem curation, problem validation and customer discovery problems.						
UNIT - I		CHALLENGE CURATION					3
Introduction: Design Thinking Principles - Design Thinking Values - Design Thinking Methods - Challenge impact setting - Framing the design challenge.							
UNIT - II		CUSTOMER-CENTRIC INNOVATION					3
Understanding Customer needs - Empathy building techniques - gap analysis - adoption barriers - observations and insights - Translating Insights into Innovation Opportunities							
UNIT - III		IDEA GENERATION					3
Identifying pains & gains - crafting value proposition - Ideation - Divergent Thinking - Ideation methods- Rules of brainstorming-Managing risks - Concept of minimum usable prototypes - Generating solution concepts.							
UNIT - IV		PROTOTYPING					3
Prototyping concepts - Palm Pilot Experiment - Fake it before make it - Prototyping - The Law of Failure - Building a Prototype-Testing the Prototypes							
UNIT - V		PITCH & PRESENTATION					3
Science of Story telling - the blueprint for story telling - Pitch Script - Pitch Presentations - Best practices to creating a compelling pitch - communication fundamentals							
P:15, SL:15 Total:30 Hours							
Weightage:							
Continuous Assessment 100%							
REFERENCE BOOKS:							
1.	Tim Brown (2019), "Change by Design: How design thinking transforms organizations and inspires innovation"						
2.	Jan Chipchase& Simon Steinhardt (2013), "Hidden in Plain Sight: How to Create extraordinary Products for Tomorrow's Customers", Harper Business 2013						
3.	Christian Madsbjerg & Mikkel B. Rasmussen (2014), "The Moment of Clarity", Harvard Business Review Press						
4.	IdrisMootee (2013), Design Thinking for Strategic Innovation, Willey						
5.	Alexander Osterwalder, Value Proposition Design: How to Create Products and Services Customers Want (Strategyzer) John Wiley & Sons, 2014						

E-RESOURCES:

- | | |
|----|---|
| 1. | Alberto Savoia, *The Pretotyping Manifesto*, 2009 |
| 2. | https://sites.google.com/a/pretotyping.org/www/the-pretotyping-manifesto |
| 3. | Jazz Factory, *All About Presentations*, http://blog.jazzfactory.in/ |
| 4. | Pretotyping Methodology, https://www.pretotyping.org/methodology.html) |

COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Identify real-world problems	PO9, PO11	-
CO2	Apply the challenge curation techniques to real-world problems.	PO9, PO11	PSO1
CO3	Analyze the problems and generate solutions to address the challenges	PO9, PO10, PO11	PSO1
CO4	Build solutions using prototyping tools & techniques	PO9, PO11	PSO2
CO5	Develop an innovation pitch to effectively communicate the idea to solve the identified problem	PO8, PO9, PO11	PSO2
CO6	Demonstrate teamwork, leadership, and entrepreneurial skills in developing innovative solutions for real-world problems.	PO9, PO10, PO11	PSO3

The Course Articulation Matrix (CAM) for defined Cos

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PSO01	PSO02	PSO03
C01	-	-	-	-	-	-	-	-	3	-	2	-	-	-
C02	-	-	-	-	-	-	-	-	3	-	3	3	-	-
C03	-	-	-	-	-	-	-	-	3	2	3	2	-	-
C04	-	-	-	-	-	-	-	-	2	-	2	-	3	-
C05	-	-	-	-	-	-	-	2	2	-	2	-	2	-
C06	-	-	-	-	-	-	-	-	3	3	3	-	-	3

Activities:

- | | |
|----|---|
| 1. | Activity 1: Problem Identification and Solution Ideation Sprint
Identify real-world problems through observations, surveys, and stakeholder interactions, understand user needs and challenges, analyze problems using simple design thinking tools, prepare a clear problem statement, generate multiple solution ideas through brainstorming, evaluate alternative solutions, select the most suitable solution, and document the problem analysis and proposed solution. |
| 2. | Activity 2: Prototype Development and Innovation Pitch Sprint
Prepare sketches or CAD models, develop a prototype or proof-of-concept model, test and validate the prototype, collect user feedback and improve the design, document the development process, prepare an innovation pitch and implementation plan, present the prototype before evaluators, and showcase teamwork, leadership, innovation, and entrepreneurial skills. |

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Problem Presentation and Value Proposition	25	Clearly presents the problem, need, and value proposition with strong justification	Presents the problem and value proposition with minor gaps	Presents the problem with limited clarity and justification
2.	Content Organization and Pitch Structure	25	Pitch is well-structured, logical, and professionally organized	Organization is adequate with minor lapses	Organization lacks clarity and logical flow
3.	Communication and Presentation Skills	25	Delivers the pitch confidently with excellent verbal and non-verbal communication	Communicates effectively with minor hesitation	Communication lacks confidence and clarity
4.	Visual Aids and Response to Questions	25	Uses highly effective visual aids and responds accurately to questions	Uses adequate visual aids and answers most questions satisfactorily	Limited visual support and difficulty responding to questions
	Total	100			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Teamwork and Collaboration	25	Actively contributes, collaborates effectively, and supports team goals	Participates well with minor collaboration issues	Participates minimally with limited teamwork
2.	Leadership and Decision Making	25	Demonstrates strong leadership, initiative, and effective decision-making	Demonstrates leadership with occasional guidance required	Shows limited leadership and decision-making ability
3.	Entrepreneurial Thinking and Innovation	25	Demonstrates excellent entrepreneurial mindset and identifies implementation opportunities	Demonstrates good entrepreneurial awareness and innovation	Demonstrates basic understanding of innovation and entrepreneurship
4.	Project Management and Professional Responsibility	25	Effectively plans, organizes, and completes assigned tasks within deadlines	Manages tasks adequately with minor delays	Shows limited planning and project management skills
	Total	100			

26NCC02	NCC Course –II (Only for NCC Students)		SEMESTER				III	
Prerequisites			Category	-	Credits			2
			Hours/ Semester	L	T	P	SL	TH
				30	0	0	30	60
COURSE OBJECTIVES								
1.	To Maintain the unity and disciplines to the students.							
UNIT - I	SOCIAL SERVICE & COMMUNITY DEVELOPMENT							6
Basic of social service and its need – Rural Development Program – NGOs Roles and Contribution – Drug abuse and Trafficking – Civic Responsibilities – Causes & Prevention of AIDS/HIV – Counter Terrorism – Corruption – Social Evil – RTI & RTE – Traffic Control Organization – Anti-Drunken Driving.								
UNIT - II	GENERAL AWARENESS & ADVENTURE							6
General Knowledge – Logical & Analytical Reasoning – Modes of Entry to Army, CAPF, Police – SSB Procedure – Para Sailing – Slithering – Rock Climbing – Cycling and Trekking.								
UNIT - III	AERO ENGINES & NAVIGATION							6
Introduction to Aero Engines and its Types – Components of Aero Engines – Principles of Propulsion – Basic Terminology – Jet Engines – Brayton Cycle – Turbo Prop Engines and its Types – Requirements of Navigation – Lines on Earth – Maps and its Types – Symbols used in Maps – Scales of Maps – Map Reading Procedure and its Aids.								
UNIT - IV	AIRFRAME & METEOROLOGY							6
Aircraft Control – Primary and Secondary – Fuselage – Main Plane and Tail Plane – Ailerons, Elevators & Rudders – Landing Gear – Importance of METT in Aviation – Atmosphere – Clouds and Precipitation – Flying Hazards.								
UNIT - V	FLIGHT INSTRUMENTS & AEROMODELLING							6
Airspeed Indicator – Altimeter – Artificial Horizon – Radar and its Type – Instruments Battery Test – Compass – History of Aero Modelling – Basic Materials & Tools – Types of Aero Modelling – Flying/Building of Aero Models – General Safety Procedure.								
L:30, P:0, SL :30, Total:60 Hours								
REFERENCE BOOKS:								
1.	William H. McRaven, <i>The Hero Code: Lessons Learned from Lives Well Lived</i> , Grand Central Publishing, 2019.							
2.	S. K. Mangal, <i>Leadership and Personality Development</i> , PHI Learning Pvt. Ltd., 2018.							
3.	N. V. K. Raju, <i>Disaster Management and Preparedness</i> , CBS Publishers, 2019.							
4.	R. P. Saini, <i>Air Navigation and Aviation Meteorology</i> , CBS Publishers, 2017.							
5.	V. K. Sharma, <i>Fundamentals of Aviation and Air Navigation</i> , Himalaya Publishing House, 2018.							

E-RESOURCES:

1.	National Cadet Corps (NCC) https://indiancc.nic.in/
2.	Ministry of Defence, Government of India https://mod.gov.in/
3.	National Disaster Management Authority (NDMA) https://ndma.gov.in/
4.	Indian Air Force https://indianairforce.nic.in/

COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Understand the importance of social service, community development, civic responsibilities, and national values.	PO6, PO8, PO11	PSO1
CO2	Apply general awareness, logical reasoning, and leadership skills in defence-oriented and adventure activities.	PO8, PO9, PO10	PSO1
CO3	Understand the principles of aero engines, propulsion systems, navigation, map reading, and related aviation concepts.	PO1, PO2, PO8	PSO2
CO4	Understand the structure, control systems, meteorological factors, and operational aspects of aircraft.	PO1, PO2, PO8	PSO2
CO5	Understand the working principles and applications of flight instruments, avionics systems, and aeromodelling techniques.	PO1, PO2, PO5, PO8	PSO2
CO6	Demonstrate discipline, leadership, teamwork, adventure spirit, and social responsibility through NCC training and community engagement activities.	PO8, PO9, PO10, PO11	PSO3

The Course Articulation Matrix (CAM) for defined Cos

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 01	PSO 02	PSO 03
CO1	-	-	-	-	-	2	-	3	-	-	2	2	-	-
CO2	-	-	-	-	-	-	-	3	3	2	-	2	-	-
CO3	2	2	-	-	-	-	-	3	-	-	-	-	2	-
CO4	2	2	-	-	-	-	-	3	-	-	-	-	2	-
CO5	2	2	-	-	2	-	-	3	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	3	3	2	-	-	3

Activities:

1.	Activity 1: Participate in community service and social awareness programmes to develop civic responsibility and social commitment.
2.	Activity 2: Participate in adventure activities such as trekking, cycling, rock climbing, and leadership camps to enhance teamwork, confidence, and decision-making skills.
3.	Activity 3: Participate in navigation, map-reading, aeromodelling, and aviation awareness programmes to gain practical knowledge of aerospace and defence-related concepts.

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Knowledge of Flight Instruments	25	Demonstrates comprehensive understanding of flight instruments and avionics systems	Demonstrates good understanding with minor gaps	Demonstrates basic understanding
2.	Technical Interpretation	25	Accurately explains instrument functions and aircraft applications	Explains concepts with minor errors	Limited explanation of concepts
3.	Aeromodelling Application	25	Effectively applies concepts in aeromodelling activities and projects	Adequately relates concepts to applications	Limited application of concepts
4.	Presentation and Communication	25	Presents ideas clearly and confidently	Communicates adequately with minor hesitation	Communication lacks clarity
	Total	100			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1	Discipline and Commitment	25	Consistently demonstrates discipline, punctuality, and commitment	Demonstrates good discipline with minor lapses	Demonstrates basic discipline
2	Leadership and Teamwork	25	Effectively leads and collaborates with peers	Participates actively with minor limitations	Limited leadership and teamwork
3	Adventure Participation and Social Responsibility	25	Actively contributes to community service and social initiatives	Participates satisfactorily in service activities	Limited participation in service activities
4	Ethical Conduct and Communication	25	Demonstrates strong patriotic values and ethical behavior	Demonstrates good values and conduct	Demonstrates basic awareness of values and ethics
	Total	100			

26MAC05	STATISTICS AND RANDOM PROCESSES		SEMESTER				IV
Prerequisites		Category	BS	Credits			3
Basic knowledge of probability, calculus, algebra, and elementary statistical methods.		Hours/ Semester	L	T	P	SL	TH
			45	15	0	30	90
COURSE OBJECTIVES							
1.	To understand the fundamental concepts and properties of standard probability distributions and inequalities used in statistical analysis.						
2.	To develop knowledge of joint distributions, conditional distributions, correlation, regression and rank correlation for multivariable data analysis.						
3.	To acquire skills in statistical measures, moments, skewness, kurtosis and curve fitting techniques using the method of least squares.						
4.	To learn hypothesis testing procedures, small sample tests, chi-square tests and variance analysis for statistical decision-making.						
5.	To understand the concepts of random processes, stationary processes, correlation functions and spectral density methods used in engineering and scientific applications.						
UNIT - I		STANDARD DISTRIBUTION					9+3
Binomial, Poisson, Exponential, Gamma and Normal Distributions and their properties - Chebychev's inequality.							
UNIT - II		TWO DIMENSIONAL RANDOM VARIABLES					9+3
Joint distributions – Marginal and Conditional distributions – Correlation, Regression and rank correlation.							
UNIT - III		BASIC STATISTICS					9+3
Measures of Central tendency: Moments, Skewness and Kurtosis, Curve fitting by the method of Least Squares –Fitting of straight lines, second degree parabolas and curves reducible to linear forms.							
UNIT - IV		TEST OF HYPOTHESIS					9+3
Test of significance: Small Sample test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.							
UNIT - V		RANDOM PROCESSES, CORRELATION AND SPECTRAL DENSITIES					9+3
Definition and examples – First order, Second order strictly stationary- Wide sense stationary processes- Auto Correlation- Cross Correlation- Properties- Power spectral density- Cross Spectral density.							
L:45, T:15, SL :30, Total:90 Hours							
Weightage: Continuous Assessment: 40% End Semester Examinations: 60%							
TEXT BOOKS:							
1.	Veerarajan. T, "Probability and Random Process With Queuing theory", 4 th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2016.						
2.	Jay L. Devore, "Probability and Statistics for Engineering and Sciences", 8 th edition, Cengage Learning, New Delhi, 2012.						

REFERENCE BOOKS:			
1.	Fruend John. E. and Miller. Irwin, "Probability and Statistics for Engineering", 5 th Edition, Prentice Hall, 1994.		
2.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45 th Edition, New Delhi, 2020.		
3.	Gupta, S.C. and Kapoor, V.K. "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi, 2015.		
E-RESOURCES:			
1.	NPTEL, "Probability and Statistics", National Programme on Technology Enhanced Learning, https://nptel.ac.in/courses/111105041		
2.	NPTEL, "Random Processes", National Programme on Technology Enhanced Learning, https://nptel.ac.in/courses/117103067		
3.	MIT OpenCourseWare, "Probability and Statistics", Massachusetts Institute of Technology, https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/		
4.	Khan Academy, "Statistics and Probability", https://www.khanacademy.org/math/statistics-probability		
5.	Stat Trek, "Statistics Tutorial and Hypothesis Testing", https://stattrek.com/hypothesis-test/hypothesis-testing		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			
		Mapping POs	Mapping PSOs
CO1	Remember and understand the fundamental concepts and methods of probability distributions, two-dimensional random variables, statistical measures, hypothesis testing and random processes, including standard distributions, correlation and regression analysis, curve fitting, significance tests, stationary processes and spectral density functions.	--	--
CO2	Apply probability distributions, statistical methods and hypothesis testing techniques, correlation analysis, curve fitting methods and random process concepts to solve practical problems in science, engineering and data analysis.	PO1	PSO1
CO3	Analyze statistical data and random processes using probability distributions, correlation and regression techniques and hypothesis testing methods, curve fitting procedures and spectral density analysis for interpreting scientific and engineering problems.	PO2	PSO1
CO4	Develop statistical and probabilistic models using random variables, hypothesis testing and random process techniques for solving engineering and research-oriented problems.	PO3	PSO2
CO5	Utilize computational and statistical tools for data analysis, curve fitting, correlation studies and spectral analysis to support effective decision-making.	PO5	PSO2
CO6	Investigate assignment-based and real-world statistical problems through analytical reasoning and interpretation of stochastic models and experimental data.	PO10	--

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1														
CO2	3											3		
CO3		2										2		
CO4			1										1	
CO5					3								1	
CO6										3				
Avg	3	2	1		3					3		2.5	1	

Activities:

1.	Students shall analyse selected data sets using statistical/computational tools such as Excel, R, Python, SPSS or any open-source software. The activity may include probability distribution analysis, correlation and regression, curve fitting, hypothesis testing and spectral analysis to support effective decision-making.
2.	Students shall prepare a short assignment report or presentation on selected real-world statistical problems involving probability distributions, two-dimensional random variables, hypothesis testing and curve fitting or random processes. This activity develops the ability to communicate statistical procedures, graphical outputs, stochastic model interpretations, results and conclusions effectively.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Selection of data set/problem	8	Suitable dataset/problem is selected and clearly understood	Dataset/problem is relevant, but needs minor clarity	Dataset/problem selection is basic or unclear
2.	Use of statistical/computational tool	8	Tool is used effectively with correct procedure	Tool is used properly with minor errors	Tool usage is limited or unclear
3.	Accuracy of analysis	8	Analysis, curve fitting, correlation or spectral computation is accurate	Analysis is mostly correct with minor errors	Analysis contains major errors
4.	Interpretation and decision-making	8	Results are clearly interpreted for effective decision-making	Interpretation is limited	Interpretation is weak or missing
5.	Presentation and documentation	8	Work is neatly organized with clear numerical presentation and documentation	Presentation is good with minor organizational issues	Presentation is satisfactory but lacks consistency
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Clarity of statistical explanation	8	Concepts and procedures are clearly explained	Explanation is understandable with minor gaps	Explanation is unclear
2.	Use of notation, graphs and representation	8	Proper statistical notation, graphs, tables and outputs are used	Minor errors in notation or representation	Poor or missing representation
3.	Organization of report/ presentation	8	Well-structured and neatly presented	Organized, but needs improvement	Poorly organized or incomplete
4.	Communication of results	8	Results and conclusions are communicated effectively	Communication is adequate, but limited	Communication is weak
5.	Overall presentation and academic quality	8	Work demonstrates excellent academic quality and professionalism	Academic quality is good with minor issues	Academic presentation is satisfactory
	Total	40			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	12	2
CO2	24	24	-	-	24	3
CO3	16	16	-	-	16	2
CO4	8	8	-	-	8	1
CO5	-	-	40	-	25	3
CO6	-	-	-	40	25	3
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC401	ANALOG CIRCUITS - II			SEMESTER			IV		
Prerequisites				Category	ES(PC)	Credits		3	
1. Analog Circuits - I				Hours/ Semester	L	T	P	SL	TH
					45	0	0	45	90
COURSE OBJECTIVES									
1.	To understand the theory and design of feedback oscillators using RC, LC, and crystal resonators.								
2.	To analyze the operation and performance of tuned amplifiers and multivibrators employed in analog circuits.								
3.	To study the internal architecture, design techniques, and characteristics of operational amplifiers.								
4.	To design analog signal processing circuits using operational amplifiers for amplification, filtering, waveform generation, and comparison.								
5.	To explore the operation and applications of data converters, timer ICs, and voltage regulator ICs in electronic system design.								
UNIT - I		OSCILLATORS							9
Block diagram - Bark hausen Criterion - Mechanism for start of oscillation and stabilization of amplitude – Design and analysis of Oscillator using Cascade connection of RC and LC filters: RC phase shift Oscillator – Wien bridge Oscillator and Twin - T oscillators - LC Oscillators: Colpitts — Hartley — Clapp- Miller and Pierce oscillators - Electrical equivalent circuit of Crystal.									
UNIT - II		TUNED AMPLIFIERS AND MULTI VIBRATORS							9
Analysis of single tuned and synchronously tuned amplifiers- Class C tuned amplifiers and their applications - Efficiency of Class C tuned Amplifier-Collector coupled and Emitter coupled Astable Multivibrator –Monostable Multivibrator-Bistable Multivibrator-Triggering Methods-Monostable and Astable Blocking Oscillators using Emitter and base timing.									
UNIT - III		OPERATIONAL AMPLIFIER DESIGN							9
Current mirror: Basic topology and its variants - Differential amplifier: Basic structure and principle of operation -Calculation of differential gain - Common Mode gain, CMRR - OP-AMP design: Differential amplifier stage –Design of gain stages and output stages—compensation-DC and AC characteristics of OP-AMP.									
UNIT - IV		APPLICATIONS OF OPERATIONAL AMPLIFIER							9
Inverting and non-inverting amplifiers-Integrator and Differentiator -Summing amplifier -Precision rectifier - Schmitt trigger and its applications - Active filters: Low pass, high pass, band pass and band stop filters - Sine wave oscillators—Comparator-Multivibrator.									
UNIT - V		DATA CONVERTERS AND SPECIAL FUNCTION ICs							9
Digital-to-Analog converters (DAC): Weighted resistor - R-2R ladder - Analog to-Digital converters (ADC): Single slope - Dual slope -Successive Approximation - Flash type - IC 555 timer and its applications - IC723- Voltage regulators.									
L:45, SL:45, Total:90 Hours									
Weightage:									
Continuous Assessment 40%									
End Semester Examinations 60%									

TEXT BOOKS:

1.	Donald Schilling, Charles Belove, Tuvia Apelewicz, Raymond Saccardi, "Electronic Circuits: Discrete and Integrated", TMH, Third Edition, 2002
2.	B.Visvesvara Rao, k.Raja Rajeswari, P.Chalam Raju Pantulu, K.Bhaskara Rama Murthy, "Electronic Circuits-II", Pearson Education, 2012

REFERENCE BOOKS:

1.	D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2011.
2.	Gayakwad, R. A., <i>Op-Amps and Linear Integrated Circuits</i> , 4th Edition, Pearson Education, 2015.
3.	Millman, J., & Halkias, C. C., <i>Integrated Electronics: Analog and Digital Circuits and Systems</i> , 2nd Edition, McGraw-Hill Education.

E-RESOURCES:

1.	https://mrcet.com/downloads/digital_notes/ECE/II%20Year/ANALOG%20CIRCUITS.pdf
2.	https://lnct.ac.in/wp-content/uploads/2020/03/Analog-Circuit-EC-405-Oscillator.pdf
3.	https://mrcet.com/downloads/digital_notes/ECE/III%20Year/05082022/Linear%20Digital%20Integrated%20Circuits.pdf
4.	https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_ee73
5.	https://youtu.be/sFv3y1sn4oE?si=rxxX69_g6SD1yWThhttp://www.digimat.in/nptel/courses/video/108105179/L62.html

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

CO1	Explain the operating principles and characteristics of oscillators, tuned amplifiers, multivibrators, operational amplifiers, data converters, and special function ICs.	--	--
CO2	Analyze the performance of oscillators, amplifiers, multivibrators, operational amplifiers, ADCs, DACs, and voltage regulator circuits.	PO1, PO2, PO3, PO4	PSO1, PSO2, PSO3
CO3	Implement and validate analog electronic circuits using simulation or hardware techniques.	PO1, PO2, PO3, PO4, PO5	PSO2, PSO3
CO4	Design oscillator, amplifier, operational amplifier, active filter, multivibrator, and data converter circuits to meet specified requirements.	PO1, PO2, PO4, PO5	PSO1, PSO2, PSO3
CO5	Evaluate analog electronic circuits and ICs for signal processing and communication applications.	PO1, PO2, PO3, PO4, PO5, PO9	PSO1, PSO2, PSO3
CO6	Develop integrated analog electronic systems by combining oscillators, amplifiers, operational amplifiers, and data converters for real-world applications.	PO1, PO2, PO3, PO5, PO9, PO10, PO11	PSO1, PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	–	3	1	1	–	–	–	–	–	1	1	2	2
CO2	3	–	2	1	1	–	–	–	–	–	1	2	2	2
CO3	2	1	2	1	2	–	–	–	–	–	1	1	2	1
CO4	2	3	2	1	2	–	–	–	–	–	1	2	1	2
CO5	2	2	3	2	2	–	–	–	1	1	2	1	2	3
CO6	2	1	2	1	2	–	–	–	–	–	1	2	1	2

Activities:

1. Design and simulate a tuned amplifier for a specified resonant frequency and bandwidth.
2. Develop a small system integrating amplifier, oscillator, and pulse-generation circuits for a chosen application.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory(1)
1.	Circuit Design	30	Correct selection of components and complete circuit design meeting specifications	Minor design errors	Design partially meets specifications
2.	Frequency & Bandwidth Calculation	30	Accurate calculations with proper justification	Minor calculation errors	Basic calculations with limited justification
3.	Simulation Implementation	20	Simulation executed correctly with all required outputs	Minor simulation issues	Simulation completed with limited results
4.	Performance Analysis	20	Accurate analysis of resonant frequency, bandwidth, gain, and selectivity	Minor errors in analysis	Basic interpretation of results
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory(1)
1.	Problem Definition & Application Selection	25	Clearly defines application and system requirements	Requirements mostly clear	Basic application identified
2.	System Design & Integration	25	Effective integration of amplifier, oscillator, and pulse-generation circuits	Minor integration issues	Basic design with limited justification
3.	Circuit Design & Calculations	25	Accurate design with proper calculations and component selection	Minor design/calculation errors	Basic design with limited justification
4.	Simulation / Hardware Implementation	25	Complete implementation with correct operation and verification	Minor implementation issues	Partially functioning system
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12			12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);

Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC402	MICROPROCESSORS AND MICROCONTROLLERS		SEMESTER				IV	
Prerequisites			Category	ES(PC)	Credits			3
1. Digital System Design			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
COURSE OBJECTIVES								
1.	To understand the architecture and operation of 8086 microprocessor.							
2.	To develop assembly language programs using 8086 microprocessor.							
3.	To understand the architecture and programming features of 8051 microcontroller.							
4.	To interface microprocessors and microcontrollers with peripheral devices and communication modules.							
5.	To analyze modern microcontroller architectures and their applications.							
UNIT - I	8086 MICROPROCESSOR ARCHITECTURE							9
Introduction to Microprocessors and Microcontrollers – Evolution of Microprocessors – 8086 Architecture – Register Organization – Memory Segmentation – Addressing Modes – Instruction Set – Assembler Directives and Operators – Assembly Language Program Development.								
UNIT - II	8086 PROGRAMMING AND INTERFACING							9
Assembly Language Programming – Arithmetic, Logical and String Manipulation Programs – Interrupt Structure – Memory Interfacing – I/O Interfacing – 8255 Programmable Peripheral Interface – 8253/8254 Timer Interface – DMA Concepts – Applications of 8086.								
UNIT - III	8051 MICROCONTROLLER ARCHITECTURE							9
8051 Architecture – Register Set – Memory Organization – Special Function Registers – I/O Ports – Timers/Counters – Serial Communication – Interrupts – Addressing Modes – Instruction Set and Programming Model.								
UNIT - IV	8051 PROGRAMMING AND INTERFACING							9
Assembly Language Programming – Embedded C Programming for 8051 – Timer Programming – Interrupt Programming – UART Programming – LCD Interfacing – ADC and DAC Interfacing – Sensor Interfacing – PWM Generation – Motor Control Applications.								
UNIT - V	ADVANCED MICROCONTROLLERS							9
PIC Microcontroller Architecture – AVR Microcontroller Overview – ARM Cortex-M Overview – Memory Organization – GPIO – Timers and Interrupts – ADC and PWM Modules – Serial Communication (UART, SPI and I ² C) – Comparison of 8051, PIC and ARM Microcontrollers – Applications in Industrial Automation, Consumer Electronics and IoT Systems.								
L:45, SL:45, Total:90 Hours								
Weightage:								
Continuous Assessment 40%								
End Semester Examinations 60%								

TEXT BOOKS:														
1.	Yu-Cheng Liu and Glenn A. Gibson, Microcomputer Systems: The 8086/8088 Family – Architecture, Programming and Design, Pearson Education, 2nd Edition, 2019.													
2.	Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson Education, 2nd Edition, 2022.													
REFERENCE BOOKS:														
1.	A.K. Ray and K.M. Bhurchandi, Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing, McGraw Hill Education, 3rd Edition, 2019.													
2.	Martin P. Bates, PIC Microcontrollers: An Introduction to Microelectronics, Newnes (Elsevier), 3rd Edition, 2011.													
3.	Alexander G. Dean, Embedded Systems Fundamentals with ARM Cortex-M Based Microcontrollers: A Practical Approach, Arm Education Media, 2nd Edition, 2021.													
E-RESOURCES:														
1.	NPTEL – Microprocessors and Microcontrollers													
2.	Intel Developer Zone – 8086 and Processor Architecture Resources													
3.	Microchip Technology Documentation and Application Notes													
4.	Arm Developer Documentation – Cortex-M Processors													
5.	Neso Academy – Microprocessors and Microcontrollers Video Lectures													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to											Mapping POs		Mapping PSOs	
CO1	Explain the architecture, organization and instruction set of 8086 microprocessor and 8051 microcontroller.										PO1		PSO1	
CO2	Apply assembly language programming concepts to develop programs using 8086 microprocessor and 8051 microcontroller.										PO1, PO2		PSO1, PSO2	
CO3	Analyze memory organization, interrupt structure and interfacing techniques of 8086 and 8051 based systems.										PO2, PO3		PSO1, PSO2	
CO4	Apply peripheral interfacing techniques using programmable devices, ADC/DAC modules and communication interfaces for embedded applications.										PO2, PO3		PSO1, PSO2	
CO5	Analyze and compare modern microcontroller architectures and select appropriate controllers for embedded applications.										PO2, PO3, PO5		PSO2, PSO3	
CO6	Study recent trends in microprocessor and microcontroller based systems such as IoT devices, industrial automation, automotive electronics and edge computing through self-learning activities and present the findings considering societal and technological impacts.										PO6, PO9, PO10, PO11		PSO3	
The Course Articulation Matrix (CAM) for defined COs:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3											3		
CO2	3	3										3	3	
CO3		3	3									3	3	
CO4		3	3									3	3	
CO5		3	3		3								3	3
CO6						3			3	3	3			3

Activities:

1.	Simulation of 8086/8051 programming and interfacing applications using software tools.
2.	Technical Seminar / Case Study on recent applications of microprocessors and microcontrollers in IoT, Industrial Automation, Automotive Electronics, Consumer Devices and Smart Systems.

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Problem formulation and requirement analysis	20	Problem requirements are clearly identified and analyzed	Problem identified with minor omissions	Problem definition lacks clarity
2.	Program development / Simulation	30	Program developed correctly and simulation executed successfully	Program developed with minor errors	Program execution is incomplete or contains major errors
3.	Interpretation of results	20	Results are clearly interpreted and justified	Results are interpreted with limited justification	Interpretation is unclear
4.	Application of microcontroller concepts	20	Appropriate microcontroller and peripherals are selected and justified	Selection is appropriate with limited justification	Selection lacks proper justification
5.	Report presentation	10	Report is clear, well-structured and technically sound	Report is structured but needs improvement	Poorly structured report
	Total	100			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Understanding of the topic	20	Clearly explains concepts with thorough understanding	Explanation is adequate with minor gaps	Limited understanding of concepts
2.	Technological and societal impact	30	Clearly discusses technological relevance and societal impact	Impact discussed but lacks depth	Impact poorly explained
3.	Evidence of self-learning	30	Uses relevant journals, standards, datasheets and technical resources	Limited use of resources	Very limited evidence of self-learning
4.	Presentation and communication	20	Presentation is clear, organized and technically sound	Presentation needs improvement	Poorly structured presentation
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12			12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC403	ANALOG COMMUNICATION				SEMESTER				IV	
Prerequisites					Category	ES(PC)	Credits			3
NIL					Hours/ Semester	L	T	P	SL	TH
						45	0	0	45	90
COURSE OBJECTIVES										
1.	Familiarize the concepts of various analog modulation and demodulation techniques.									
2.	To understand the sources of noise and its effects in Communication systems.									
3.	To gain knowledge of the performance of receiver in the presence of noise.									
4.	To analyze and solve the noise performance of the receiver.									
5.	To study the limits set by Information Theory.									
UNIT - I		AMPLITUDE MODULATION								9
Introduction to communication systems – Need for modulation – Generation and demodulation of AM, DSB-SC, SSB-SC- VSB signals - Filtering of sidebands - Comparison of amplitude modulation systems - Frequency translation - Frequency division multiplexing - AM Super heterodyne receiver.										
UNIT - II		ANGLE MODULATION								9
Angle modulation: Phase and Frequency modulation - Narrowband and Wideband FM - Transmission bandwidth of FM signals - Generation of FM signal – Direct FM – Indirect FM - Demodulation of FM signals - FM stereo multiplexing - PLL – Nonlinear model and linear model of PLL - FM Super heterodyne receiver.										
UNIT - III		NOISE PERFORMANCE OF DSB, SSB RECEIVERS								9
Noise: Types of Noise - Noise figure - Noise temperature - Noise Equivalent Bandwidth – Noise in cascaded systems - Representation of Narrowband Noise in terms of In-phase and Quadrature components - Receiver Model - Noise in DSB- SC Receiver - Noise in SSB Receiver.										
UNIT - IV		NOISE PERFORMANCE OF AM AND FM RECEIVERS								9
Noise in AM receivers: Threshold effect - Noise in FM receivers: Capture effect - FM threshold effect - FM threshold reduction – Pre-emphasis and De-emphasis in FM – Comparing the performance of AM and FM.										
UNIT - V		INFORMATION THEORY								9
Uncertainty - Information and entropy - Rate of information - Joint Entropy and Conditional Entropy - Mutual information- Discrete memory less channel - Channel Capacity - Shannon’s Theorem - Continuous Channel - Shannon Hartley Theorem - BW and S/N Trade-off - Huffman and Shannon – Fanocodes -Data Compression.										
L:45, SL:45, Total:90 Hours										
Weightage: Continuous Assessment 40% End Semester Examinations 60%										
TEXT BOOKS:										
1.	Simon Haykin, “Communication Systems”, 5th Edition, International Student Version, John Wiley & sons, NY, 2010.									
2.	R.P. Singh & S.D.Spare, “Communication Systems, Analog & Digital”, Tata McGraw Hill, 1995.									

REFERENCE BOOKS:

1.	Taub and Schilling, "Principles of communication systems", TMH, New Delhi, 2008
2.	Sanjay Sharma, "Analog communication Systems", 6 th Edition, S.K.Kataria& Sons, New Delhi, 2013.
3.	Bruce Carlson.A, Paul B.Crilly, "Communication systems", 5thEdition, McGraw-Hill Int., 2009.

E-RESOURCES:

1.	https://www.telecommunications-tutorials.com/
2.	http://www.nptelvideos.in/2012/11/communication-engineering.html
3.	https://www.tutorialspoint.com/analog_communication/analog_communication_introduction.html
4.	http://www.digimat.in/nptel/courses/video/117105143/L01.html
5.	https://onlinecourses.nptel.ac.in/noc21_ee74/preview

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

CO1	Explain the fundamental principles of analog communication systems including modulation techniques, noise performance in receiver models and information theoretic concepts.	--	PSO1,PSO2
CO2	Apply mathematical and engineering principles to analyze the generation, transmission, demodulation, noise types & components, Statistical properties of channels under practical constraints.	PO1-PO4	PSO1,PSO2, PSO3
CO3	Analyze the performance of receiver model in the presence of noise characteristics and effects of AM & FM systems and channel capacity concepts.	PO1-PO4	PSO2,PSO3
CO4	Analyze the model of complete analog communication systems by integrating modulation techniques & receiver noise.	PO6,PO8, PO9,PO10, PO11	PSO1,PSO2, PSO3
CO5	Use modern engineering tools such as MATLAB/Simulink or equivalent software to model and evaluate analog communication systems and present the results through suitable graphical representations.	PO5,PO6, PO9,PO10, PO11	PSO1,PSO2, PSO3
CO6	Demonstrate professional competency by working individually or in teams to communicate, present and justify solutions related to analog communication systems through seminar presentation or case studies or prepare technical report.	PO6,PO9, PO10, PO11	PSO1,PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1												1	2	
CO2	1	2	2	2								1	2	2
CO3	1	2	2	3									2	2
CO4						3		1	3	2	3	2	3	2
CO5					3	2			3	3	3	1	3	2
CO6						2			3	3	3	1	2	3

Activities:

1.	Design and simulation of AM, DSB-SC, SSB-SC and FM Communication Systems using MATLAB/Simulink. (CO5)
2.	Case Study/Technical Seminar on Analog Communication Systems in Real-world Applications (CO6) (independent Only).

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Problem formulation & system modeling	20	Communication system is correctly modeled with all required parameters	System is modeled with minor omissions in parameters or assumptions	System model is incomplete or incorrectly defined
2.	Use of MATLAB/Simulink tools	30	Appropriate tools/functions are effectively used and simulation is executed without errors	Tools are used correctly with minor errors or guidance required	Limited use of tools; simulation contains significant errors
3.	Simulation results & graphical representation	20	Simulation results are accurate and presented well-labeled graphs/plots	Results are obtained with minor issues in plots or labeling	Results and graphical representations are incomplete or unclear
4.	Report presentation	10	Report is clear and well structured	Report is structured, but needs improvement	Poorly structured report
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Understanding of Analog Communication Concepts	20	Clearly explains concepts, principles, and applications of analog communication systems	Explanation is adequate but lacks depth in some areas	Limited understanding of concepts and applications
2.	Technical Analysis & Justification of Solutions	30	Solutions are well-analyzed, technically sound, and strongly justified with relevant examples	Solutions are analyzed with partial justification	Analysis and justification are weak or incomplete
3.	Evidence of Self-Learning	30	Extensive use of relevant journals, research articles, standards, and technical sources	Limited use of relevant technical sources	Very few or no relevant sources referred
4.	Presentation & Communication Skills	20	Presentation is clear and well-structured	Presentation needs improvement	Poorly structured with unclear communication
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12			12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC404	CONTROL SYSTEMS		SEMESTER				IV	
Prerequisites			Category	ES(PC)	Credits		3	
NIL			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
COURSE OBJECTIVES								
1.	To understand the basic parts of a control system and how they are represented.							
2.	To learn how to model simple physical systems using basic mathematical equations.							
3.	To study how systems behave in time domain, frequency domain, and stability conditions.							
4.	To learn the basics of state variable method for system analysis.							
5.	To understand how to check system performance and design simple control systems.							
UNIT – I	MATHEMATICAL MODELS OF PHYSICAL SYSTEMS							9
Basic Elements of Control System – Differential equations of physical systems – Open loop and Closed loop systems – Transfer function – Modelling of Electrical systems – Translational and rotational mechanical systems – Block diagram reduction Techniques – Signal flow graph – Mason’ Gain Formula.								
UNIT – II	TIME RESPONSE ANALYSIS							9
Standard test signals – Impulse and Step Response analysis of First and second order systems – Time domain specifications – P, PI, PD and PID controllers – Steady state errors and error constants.								
UNIT - III	FREQUENCY RESPONSE ANALYSIS							9
Sinusoidal Transfer Functions and frequency Response - Frequency Domain specifications for second order system - Frequency response plots: Bode Plot - Polar Plot –Linear system design: Lead, Lag and Lead Lag Compensators.								
UNIT – IV	STABILITY ANALYSIS							9
Stability – Routh-Hurwitz Criterion – Nyquist Stability Criterion – Nyquist Plot – Relative Stability – Root Locus Technique – Construction of Root Locus – Stability, Dominant Poles – Application of Root Locus.								
UNIT – V	STATE VARIABLE ANALYSIS							9
Concept of state, state variable and state model - State space representation of linear Continuous Time systems – solutions of State equations – Transfer function from State Variable Representation – Concepts of Controllability and Observability.								
L:45, SL:45, Total:90 Hours								
Weightage: Continuous Assessment 40% End Semester Examinations 60%								
TEXT BOOKS:								
1.	A.Nagoorkani, "Control Systems" 3 rd Edition, RBA publications, 2011.							
2.	I.J Nagrath and M. Gopal, "Control System Engineering", 5 th Edition, New Age International Edition, 2018.							

REFERENCE BOOKS:

1. A.Anand Kumar, "Control Systems", 2nd Edition, Prentice Hall of India, 2012
2. Norman SNise, "Control Systems Engineering", 7th Edition, Wiley Publications, 2015.
3. Benjamin.C.Kuo, Automatic Control Systems, 7th Edition, PHI, 2009.

E-RESOURCES:

1. <https://www.edx.org/course/introduction-control-system-design-first-mitx-6-302-0x>
2. https://onlinecourses.nptel.ac.in/noc17_ee12
3. https://onlinecourses.nptel.ac.in/noc22_ee31/preview
4. https://nptel.ac.in/courses/108106098?utm_source=chatgpt.com
5. http://ctms.engin.umich.edu/CTMS/index.php?aux=Home&utm_source=chatgpt.com

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

CO1	Understand the basic concepts and mathematical models of control systems.	--	PSO1, PSO2
CO2	Apply control system principles to analyze time response, frequency response, and steady state performance.	PO1, PO2	PSO1, PSO2
CO3	Analyze the stability and performance of control systems using different analytical techniques.	PO2, PO3	PSO1, PSO2
CO4	Design controllers and compensators to improve control system performance and stability.	PO3, PO4	PSO1, PSO2, PSO3
CO5	Study and present control system models and applications through self-learning and teamwork activities.	PO5, PO9, PO10, PO11	PSO1, PSO2, PSO3
CO6	Analyze and simulate control systems using modern engineering tools and interpret the results.	PO5, PO10, PO11	PSO1, PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1												3	1	
CO2	3	3										3	2	
CO3		3	3									3	2	
CO4			3	3								3	3	2
CO5					3				3	3	3	2	2	3
CO6					3				2	2		2	3	2

Activities:

1. Study a selected **control system model and its real-world application** using suitable simulation tool.
Develop the mathematical model of the system, simulate its response, and analyze its performance under different input conditions. Work as a team to collect relevant information, perform simulations, interpret results, and present the findings.
Explain the system behavior using graphs such as **time response, step response, and stability characteristics**, and prepare a detailed report along with a presentation summarizing your learning outcomes and analysis.
2. **Stability Analysis Case Study:** Design and simulate a control system and study its **stability using root locus or Bode plot methods**. Interpret the system behavior based on the simulation results.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Understanding of control system concepts	20	Concepts and applications are clearly explained with proper understanding	Problem defined, but some of the boundary conditions are unclear	Problem statement defined but unclear boundary conditions
2.	Self-learning and information collection	20	Relevant information collected from multiple sources with good analysis	Simulation is done, but minor error in plots	Simulations and plots are incomplete
3.	Teamwork and participation	20	Actively contributes and collaborates effectively in team activities	Results are interpreted but limited justification	Unclear interpretation
4.	Presentation and communication	20	Findings are clearly presented with effective communication	Presentation is understandable with minor issues	Poor presentation and communication
5.	Report preparation and organization	20	Report is clear and well structured	Report is structured, but needs improvement	Poorly structured report
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	System modelling and simulation	30	Control system model is correctly developed and simulation is completed accurately	Simulation is completed with minor errors	Simulation is incomplete or contains major errors

2.	Plots and graphical representation	20	Response plots and graphs are clear, accurate, and well-labelled	Plots are generated with minor issues	Plots are unclear or incomplete
3.	Analysis and interpretation of results	25	Results are correctly analyzed and clearly interpreted	Results are analyzed with limited interpretation	Poor or unclear interpretation of results
4.	Use of simulation tools	15	Appropriate simulation tools are effectively used	Tools are used with minor guidance required	Difficulty in using simulation tools
5.	Report and presentation	10	Report and presentation are clear, organized, and professional	Report is understandable but needs improvement	Poorly organized report and presentation
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12			12	2
CO2	24	24			24	3
CO3	12	12			12	2
CO4	12	12			12	2
CO5			40		20	2
CO6				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC405	TRANSMISSION LINES AND WAVEGUIDES		SEMESTER				IV
Prerequisites		Category	ES(PC)	Credits			3
1. Electromagnetism		Hours/ Semester	L	T	P	SL	TH
			45	0	0	45	90
COURSE OBJECTIVES							
1.	To understand the fundamentals of transmission lines and wave propagation.						
2.	To analyze the impedance matching and standing-wave characteristics using Smith Charts.						
3.	To examine the TE and TM wave propagation in rectangular waveguides.						
4.	To study the characteristics of circular waveguides and cavity resonators.						
5.	To apply planar transmission-line concepts in microwave and RF systems.						
UNIT – I		TRANSMISSION LINE THEORY					9
Introduction to Different types of transmission lines – Lumped and distributed constants of transmission lines– General Solution of the transmission line equations– Input and Transfer Impedance-Open and Short-circuited transmission lines - Wavelength and Velocity of Propagation - Waveform distortion and Distortion less transmission line – Loading of transmission line and methods of loading-Reflection on a line not terminated in characteristic impedance– Reflection coefficient –Reflection factor and reflection loss.							
UNIT – II		THE LINE AT RADIO FREQUENCIES					9
Parameters of open-wire and coaxial transmission lines at radio frequencies; input impedance of dissipation less transmission lines; open-circuited and short-circuited transmission lines; standing waves and standing wave ratio- impedance transformation using $\lambda/8$, $\lambda/4$, and $\lambda/2$ transmission lines; Smith Chart and its applications; solution of transmission-line problems using the Smith Chart; single-stub and double-stub impedance matching techniques							
UNIT – III		RECTANGULAR WAVEGUIDES					9
Electromagnetic wave propagation between parallel perfectly conducting planes- Transverse Electric and Transverse Magnetic waves and their characteristics- Transverses Electromagnetic waves: Transverse Electric waves in rectangular waveguides -Transverse Magnetic waves in rectangular waveguides; cut-off wavelength, cut-off frequency, phase velocity, and group velocity; impossibility of Transverse Electromagnetic wave propagation in waveguides- dominant mode in rectangular waveguides- attenuation of TE and TM modes- wave impedance and excitation of waveguide modes.							
UNIT – IV		CIRCULAR WAVE GUIDES AND RESONATORS					9
Bessel functions and their applications in waveguide analysis – Solution of field equations in cylindrical coordinates – TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominant mode in circular waveguide – excitation of waveguide modes – Microwave cavity resonator - rectangular cavity resonators - circular cavity resonator- resonant frequencies and quality factor of cavity resonators.							
UNIT – V		PLANAR TRANSMISSION LINES					9
Introduction to planar transmission lines-strip lines, microstrip lines-coupled microstrip lines-slot line, coplanar waveguide - field distribution in microstrip lines; characteristic impedance and design equations of microstrip lines; losses in microstrip lines; analysis of coaxial transmission lines and their distributed parameters,							
L:45, SL:45, Total:90 Hours							

Weightage:

Continuous Assessment 40%

End Semester Examinations 60%

TEXT BOOKS:

- | | |
|----|--|
| 1. | J.D. Ryder "Networks, Lines and Fields", 2 nd edition, PHI, New Delhi, 2007. |
| 2. | Edward C. Jordan & Keith G. Balmain – Electromagnetic Waves and Radiating Systems, 2nd Edition, 2010 |

REFERENCE BOOKS:

- | | |
|----|--|
| 1. | Matthew N. O. Sadiku – Elements of Electromagnetics, 7th Edition (2018, Oxford University Press) |
| 2. | David M. Pozar: "Microwave Engineering", 4th Edition, John Wiley, 2012 |
| 3. | Samuel Y. Liao – Microwave Devices and Circuits, 3rd Edition (2003, Pearson) |

E-RESOURCES:

- | | |
|----|---|
| 1. | https://nptel.ac.in/courses/108106157 |
| 2. | https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-fall-2005 |
| 3. | https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-fall-2005/resources/lec10 |
| 4. | https://www.3ds.com/products-services/simulia/products/cst-studio-suite |
| 5. | https://www.keysight.com/us/en/products/software/pathwave-design-software/pathwave-advanced-design-system.html?utm_source=chatgpt.com |

COURSE OUTCOMES (COs) /**At the end of the course, the students will have the ability to****Mapping
POs****Mapping
PSOs**

COs	At the end of the course, the students will have the ability to	Mapping POs	Mapping PSOs
CO1	Explain the fundamentals of transmission lines, wave propagation, and waveguides.	--	PSO1, PSO2
CO2	Apply transmission-line theory, Smith Chart techniques, to solve RF and microwave engineering problems	PO1	PSO1, PSO2, PSO3
CO3	Analyze the characteristics of transmission lines and waveguides.	PO2	PSO1, PSO2
CO4	Design impedance-matching networks and planar transmission-line components for RF and microwave applications.	PO3	PSO1, PSO2, PSO3
CO5	Use modern engineering tools and self-learning methods to study advanced concepts in transmission lines & waveguides, and present the findings while considering societal and economic impacts.	PO6, PO9, PO10, PO11	PSO1, PSO2, PSO3
CO6	Study and apply ethical practices while working in teams to solve and present transmission line and waveguide problems using simulation tools.	PO6, PO9	PSO1, PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1												2	2	
CO2	3											3	3	2
CO3		3										3	2	
CO4			3									3	3	2
CO5						3			3	3	3	2	3	3
CO6						3			3			2	2	3

Activities:

1.	Study the use of transmission lines and waveguides in (i) 5G/6G communication systems (iii) Satellite communication (ii) Automotive radar (iv) Medical imaging equipment Analyze societal benefits, economic feasibility, and sustainability aspects.
2.	Solve transmission line and waveguide problems using simulation tools and presentation of results

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Technical Analysis	20	Provides accurate analysis of transmission line and waveguide characteristics, performance, and operation.	Provides adequate technical analysis with minor inaccuracies.	Provides limited technical analysis with several gaps.
2.	Social and economic based analysis	20	Thoroughly evaluates societal benefits and Critically analyzes implementation costs,	Adequately discusses societal benefits and major economic factors	Provides brief discussion of societal impacts. Limited economic analysis
3.	Sustainability Evaluation	20	Clearly evaluates energy efficiency, resource utilization	Discusses sustainability considerations adequately.	Provides limited discussion of sustainability issues.
4.	Research Quality and Use of References	20	Uses multiple high-quality sources;	Uses relevant sources with proper citations and organization.	Uses limited sources or inconsistent citations.

5.	Report Writing and Presentation	20	highly professional, well-structured, and communicate findings effectively	Report and presentation are clear with minor deficiencies.	Report and presentation are adequate but lack clarity or organization.
	Total	100			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Ethical Practice	20	Follows all academic integrity rules; no plagiarism; proper citation of tools/data	Minor issues in citation or documentation	Partial awareness of ethics
2.	Teamwork & Participation	20	Active contribution and coordination in team activities	Good participation	Limited participation
3.	Use of Simulation Tools (MATLAB / HFSS / CST / ADS)	20	Efficient use of tools with correct results	Uses tools with minor errors	Uses tools with guidance
4.	Problem Solving in Transmission Lines & Waveguides	20	Correct and complete solution	Mostly correct solution with minor errors	Basic level solution with guidance
5.	Presentation & Reporting	20	Clear, well-structured report/presentation	Good presentation with minor issues	Average clarity in report/presentation
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
C01	12	12			12	2
C02	24	24			24	3
C03	12	12			12	2
C04	12	12			12	2
C05			40		20	2
C06				40	20	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC406		ANALOG CIRCUITS - II LABORATORY		SEMESTER			IV		
Prerequisites				Category	ES(PC)	Credits		2	
				Hours/ Semester	L	T	P	SL	TH
					0	0	45	15	60
COURSE OBJECTIVES									
1.	Understand the working principles of oscillators, amplifiers, multivibrators, and IC-based circuits.								
2.	Design and construct BJT circuits such as RC phase shift, Wien bridge, Hartley, Colpitts oscillators, tuned amplifiers, and multivibrators.								
3.	Implement and test Op-Amp based circuits like amplifiers, filters, oscillators, Schmitt trigger, and multivibrators.								
4.	Learn to use IC 741, IC 555 timer, and LM723 voltage regulator for different electronic applications.								
5.	Analyze and measure the performance of electronic circuits using suitable laboratory instruments.								
EXPERIMENTS									
1.	Design of RC Phase shift oscillator and Wein Bridge oscillator.								
2.	Design of Hartley and Colpitts oscillator.								
3.	Design of Tuned Class C power Amplifier.								
4.	Design of Astable, Monostable and Bistable multivibrators using BJ T.								
5.	Simulation of Astable, Monostable and Bistable multivibrators.								
6.	Design and verification of basic Circuits using Op - amp 741.								
7.	Active Low pass, High pass and Band pass filter using Op - amp 741.								
8.	Astable, Mon stable multivibrators using Op-amp.								
9.	Schmitt Trigger using op-amp.								
10.	Phase shift and Wien bridge oscillator using Op-amp.								
11.	Astable and Monostable multivibrators using 555 Timer.								
12.	High voltage regulator using LM723.								
P:45, SL:15, Total:60 Hours									
Weightage:									
Continuous Assessment 60%									
End Semester Examinations 40%									
TEXT BOOKS:									
1.	A.S. Sedra and K.C. Smith, Microelectronic Circuits, 8 th edition, Oxford University Press, 2020.								
2.	S. Salivahanan and N. Suresh kumar, "Electronic Devices and Circuits", 5e, McGraw Hill Education, 2022.								

REFERENCE BOOKS:														
1.	Donald A. Neamen. "Semiconductor Physics and Devices" 4 th Edition, McGraw Hill Education 2021.													
2.	Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" 11 th edition, PHI, 2017.													
3.	Ben G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2015.													
E-RESOURCES:														
1.	https://nptel.ac.in/courses/108108112													
2.	https://nptel.ac.in/courses/117103063													
3.	http://www.electronics-tutorials.ws/													
4.	https://nptel.ac.in/courses/108101091													
5.	https://www.circuitlab.com?utm_source=chatgpt.com													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to											Mapping POs		Mapping PSOs	
CO1	Understand the basic concepts and working principles of oscillators, tuned amplifiers, multivibrators, and IC-based electronic circuits.										PO1, PO2		PSO1, PSO2	
CO2	Design and construct BJT-based circuits such as RC phase shift oscillator, Wien bridge oscillator, Hartley oscillator, Colpitts oscillator, Class-C tuned amplifier, and multivibrators.										PO1, PO2, PO3, PO5		PSO1, PSO2	
CO3	Implement and analyze Op-Amp 741 based circuits including amplifiers, active filters, oscillators, Schmitt trigger, and multivibrators.										PO1, PO2, PO4, PO5		PSO1, PSO2, PSO3	
CO4	Apply IC 555 timer and LM723 voltage regulator concepts to design and test waveform generator and power supply circuits.										PO1, PO2, PO3 PO4, PO5, PO11		PSO1, PSO2, PSO3	
CO5	Perform laboratory activities involving simulation, construction, testing, and troubleshooting of analog electronic circuits using appropriate components and instruments.										PO1, PO2, PO3, PO5, PO9, PO10		PSO1, PSO2, PSO3	
CO6	Analyze and evaluate the performance of electronic circuits by measuring parameters such as frequency, gain, bandwidth, waveform characteristics, and voltage regulation.										PO1, PO2, PO3, PO5, PO9, PO10		PSO1, PSO2, PSO3	
The Course Articulation Matrix (CAM) for defined COs:														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	3	2	–
CO2	2	3	3	–	2	–	–	–	–	–	–	3	2	–
CO3	2	3	–	3	2	–	–	–	–	–	2	2	3	1
CO4	2	3	3	2	2	–	–	–	–	–	–	2	3	1
CO5	1	2	2	–	2	–	–	–	3	3	1	1	2	2
CO6	1	2	2	–	2	–	–	–	3	3	1	1	2	2

Activities:

- | | |
|----|--|
| 1. | Simulate and verify the performance of an op-amp-based multivibrator using suitable software tools. |
| 2. | Technical report preparation: Compare IC 723 voltage regulator with modern regulator ICs and present findings. |

Rubrics for evaluation: C05

Sl. No.	Criteria	Marks	Excellent (5)	Good (4)	Satisfactory (3)
1.	Circuit Design and Simulation Setup	20	Correct op-amp multivibrator circuit designed with proper component selection and simulation parameters.	Circuit designed with minor errors in component values or settings.	Basic circuit simulation completed with guidance.
2.	Simulation Implementation	20	Simulation performed accurately with proper connections and software tools; output waveform obtained successfully.	Simulation completed with minor corrections required.	Simulation performed with instructor assistance.
3.	Testing and Measurement	20	Accurate measurement of output waveform parameters such as frequency, amplitude, and time period.	Measurements obtained with minor deviations.	Basic waveform measurements performed with support.
4.	Analysis and Interpretation	20	Detailed analysis of multivibrator operation and comparison of simulation results with theoretical values.	Good analysis with minor omissions.	Basic comparison with theoretical values.
5.	Documentation and Presentation	20	Well-organized report with circuit diagram, calculations, observations, results, and conclusions.	Report complete with minor deficiencies.	Report contains essential details only.
	Total	100			

Rubrics for evaluation: C06

Sl. No.	Criteria	Marks	Excellent (5)	Good (4)	Satisfactory (3)
1.	Technical Content and Research	20	Detailed comparison of IC 723 and modern regulator ICs with accurate technical parameters and references.	Comparison includes major features with minor missing details.	Basic information collected with limited comparison.

2.	Analysis and Comparison	20	Thorough analysis of voltage range, regulation, efficiency, protection features, and applications.	Good comparison with some parameters analyzed.	Basic comparison of features provided.
3.	Understanding and Interpretation	20	Demonstrates clear understanding of regulator operation and explains advantages and limitations of each IC.	Good understanding with minor gaps in explanation.	Basic explanation with guidance.
4.	Report Preparation	20	Well-structured report with introduction, technical comparison, tables, findings, and conclusion.	Report is complete with minor formatting or content issues.	Report contains essential details only.
5.	Presentation and Communication	20	Clear and effective presentation of findings with proper technical explanation.	Presentation is understandable with minor improvements needed.	Basic presentation with limited explanation.
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Laboratory Component		Percentage allocation	Mapping Strength
	Evaluation of Student Work, Observation of Record and Model Test	Activities		
C01	20	20	20	2
C02	20	20	20	2
C03	20	20	20	2
C04	20	20	20	2
C05	10	10	10	2
C06	10	10	10	2
Total	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26EC407	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY		SEMESTER				IV
Prerequisites		Category	ES(PC)	Credits			2
		Hours/ Semester	L	T	P	SL	TH
			0	0	45	15	60
COURSE OBJECTIVES							
1.	To learn the basics of 8086 and 8051 programming using assembly language.						
2.	To perform arithmetic, logical, and data processing operations using microprocessors and microcontrollers.						
3.	To understand and use different interfacing devices such as keyboards, displays, ADCs, and DACs.						
4.	To develop simple embedded system applications like traffic light control and stepper motor control.						
5.	To learn communication and control techniques through serial/parallel communication and peripheral interfacing.						
EXPERIMENTS							
8086 Programs							
1.	Kit Familiarization.						
2.	Implementation of Basic Arithmetic and Logic operations.						
3.	Implementation of Square, Square root and Cube Program.						
4.	Implementation of Code conversion and Matrix operations.						
5.	Implementation of String manipulation operations and Sorting and Searching.						
6.	Peripheral Interfacing of keyboard and display.						
7.	Implementation of Traffic light Control.						
8.	Implementation of Serial and Parallel Communication.						
9.	Implementation of Stepper Motor Control.						
8051 Programs							
10.	Implementation of basic arithmetic and Logical operations.						
11.	Implementation of finding Square and Cube, 2's complement of a number.						
12.	Implementation of programs on different addressing modes.						
13.	A/D and D/A interfacing.						
P:45, SL:15, Total:60 Hours							
Weightage:							
Continuous Assessment 60%							
End Semester Examinations 40%							

TEXT BOOKS:

1.	Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware", 3 rd edition, McGraw Hill Education, 2017.
2.	Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Danny Causey, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2 nd edition, Pearson Education, 2009.

REFERENCE BOOKS:

1.	A. K. Ray and K. M. Bhurchandi, "Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing", 3 rd edition, McGraw Hill Education, 2018.
2.	Ramesh S. Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 6 th edition, Penram International Publishing, 2019.
3.	Kenneth J. Ayala and Dhananjay V. Gadre, "The 8051 Microcontroller and Embedded Systems", 2 nd edition, Cengage Learning, 2010.

E-RESOURCES:

1.	https://www.geeksforgeeks.org/8086-microprocessor-programs/
2.	https://www.tutorialspoint.com/microprocessor/microprocessor_8086_programs.htm
3.	https://www.ritchennai.edu.in/wp-content/uploads/2019/07/Microprocessor-Lab-Manual.pdf
4.	https://www.nitttrc.ac.in/nptel/courses/video/117104072/Lab_Manual.pdf
5.	https://www.annauniv.edu/cse/files/8051_microcontroller_lab_manual.pdf

COURSE OUTCOMES (Cos) /**At the end of the course, the students will have the ability to****Mapping
Pos****Mapping
PSOs**

CO1	Understand the architecture and operation of 8086 and 8051 systems through hands-on experiments.	--	PSO1, PSO2
CO2	Execute assembly language programs for arithmetic, logical, and numerical computations.	PO1	PSO1, PSO2
CO3	Develop programs for data conversion, matrix processing, and string manipulation tasks.	PO2, PO3	PSO1, PSO2
CO4	Utilize different addressing modes and instruction sets effectively in program development.	PO5	PSO1, PSO2, PSO3
CO5	Perform hardware interfacing with input/output devices and data converters.	PO6, PO9, PO10, PO11	PSO1, PSO2, PSO3
CO6	Build and test embedded control and communication applications using microprocessor and microcontroller platforms.	PO6, PO9, PO10, PO11	PSO1, PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	1			2						1			
CO2	3	2	1		2						1			
CO3	3	3	2	1	2						1			
CO4	3	2	1		2						1			
CO5	3	2	3	2	3	1		1			1			
CO6	3	3	3	2	3	1		1	1	1	2			

Activities:	
1.	Design and Implement a digital stopwatch using 8086 and seven-segment display.
2.	Design a water-level monitoring system using the 8051 microcontroller. LEDs indicate Empty, Low, Medium, and Full levels based on sensor inputs.

Rubrics for evaluation: C05

Sl. No.	Criteria	Marks	Excellent (5)	Good (4)	Satisfactory (3)
1.	Hardware Design and Interfacing	20	Correct interfacing of 8086, seven-segment display, timer, and control switches with proper circuit design.	Minor errors in interfacing or component selection.	Basic hardware setup completed with guidance.
2.	Program Development	20	Stopwatch program correctly implements Start, Stop, Reset, and time-counting functions.	Program executes with minor logical or timing errors.	Basic stopwatch functions implemented with assistance.
3.	Circuit Implementation and Testing	20	Hardware assembled accurately; stopwatch operates reliably under all conditions.	Minor wiring or testing issues corrected independently.	Stopwatch operates partially with instructor assistance.
4.	Functional Verification and Analysis	20	Accurate timing operation verified; results analyzed and compared with expected values.	Functional verification completed with minor omissions.	Basic testing and verification performed.
5.	Documentation and Demonstration	20	Well-organized report including circuit diagram, flowchart, program, observations, and conclusions; excellent demonstration.	Report complete with minor deficiencies; good demonstration.	Report contains essential details only; satisfactory demonstration.
	Total	100			

Rubrics for evaluation: C06

Sl. No.	Criteria		Excellent (5)	Good (4)	Satisfactory (3)
1.	System Design and Sensor Interfacing	20	Correct interfacing of water-level sensors, LEDs, and 8051 with proper circuit design and logic.	Minor errors in sensor interfacing or circuit design.	Basic design completed with instructor guidance.
2.	Program Development	20	Program accurately detects water levels and controls Empty, Low, Medium, and Full indicators.	Program functions with minor logical errors.	Basic level detection implemented with assistance.

3.	Hardware Implementation	20	Circuit assembled correctly with proper wiring; all indicators function reliably.	Minor implementation issues corrected independently.	System operates partially with instructor support.
4.	Testing and Performance Evaluation	20	Accurate detection and indication of all water levels; thorough performance analysis.	Most levels detected correctly with minor deviations.	Basic testing performed with acceptable results.
5.	Documentation and Presentation	20	Comprehensive report including circuit diagram, program flowchart, source code, test results, observations, and conclusions.	Report complete with minor deficiencies.	Report contains essential information only.
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Laboratory Component		Percentage allocation	Mapping Strength
	Evaluation of Student Work, Observation of Record and Model Test	Activities		
CO1	20	20	20	2
CO2	20	20	20	2
CO3	20	20	20	2
CO4	20	20	20	2
CO5	10	10	10	2
CO6	10	10	10	2
Total	100	100	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26MCC02	ENVIRONMENTAL SCIENCE AND ENGINEERING		SEMESTER				IV	
Prerequisites			Category	MC	Credits			3
Nil			Hours/ Semester	L	T	P	SL	TH
				45	-	-	45	90
COURSE OBJECTIVES								
1.	To understand the fundamental concepts of ecology, biodiversity, environmental pollution, sustainable energy resources, climate change, and environmental sustainability relevant to engineering and society.							
2.	To acquire the ability to analyze environmental issues, pollution sources, biodiversity conservation strategies, and climate change mitigation measures using scientific principles.							
3.	To examine the interrelationships between ecosystems, energy resources, environmental management practices, and sustainable development goals.							
4.	To assess the suitability of sustainable technologies, renewable energy resources, environmental policies, and management strategies for addressing environmental challenges.							
5.	To develop practical and self-learning skills through environmental observations, case studies, field-based activities, and sustainability assessments, and to interpret findings for real-world applications.							
UNIT - I		ECOLOGY AND BIODIVERSITY:						9
Ecology – Definition, ecosystem – types – components (biotic and abiotic) – function – energy flow in ecosystem – components of forest, desert, river and ocean ecosystem – food chain and food web – ecological pyramid – ecological succession. Biodiversity – levels – values – biodiversity hot spots and hope spots in India – endangered and endemic species – threats and conservation of biodiversity.								
Activities								
1. Study of local ecosystem and identification of biotic and abiotic components. 2. Documentation of local biodiversity and endangered species.								
UNIT - II		ENVIRONMENTAL POLLUTION:						9
Air pollution – sources, effects, control measures – Water pollution –sources, effects, control measures – Noise pollution – sources, effects, control measures –Soil pollution – causes, effects and control measures – solid and electronic waste management – Environmental protection acts.								
Activities								
1. Survey of air, water, noise, and solid waste pollution sources in the locality. 2. Preparation of waste segregation and management plan.								
UNIT - III		SUSTAINABLE ENERGY RESOURCES:						9
Energy management and conservation – Need of new sources – Different types new energy sources – Applications of solar energy, wind energy, hydrogen energy, ocean energy and tidal energy – Concept, origin and power plants of geothermal energy.								
Activities								
1. Comparative study of renewable and non-renewable energy resources. 2. Energy audit of classroom/home.								
UNIT - IV		CLIMATE CHANGE AND MANAGEMENT:						9
Causes for climate change – global warming – greenhouse effect – acid rain– ozone layer depletion – carbon sequestration, carbon foot print, carbon credit, Kyoto protocol – green climate fund (GCF), climate investment fund (CIF) – intergovernmental panel on climate change (IPCC) – clean development mechanism (CDM) – Paris agreement.								
Activity								
Carbon footprint estimation of an individual or institution.								

UNIT - V		ENVIRONMENTAL SUSTAINANILITY AND PRACTICES:		9
Sustainability – concept, needs and challenges – economic, social, and environmental aspects of sustainability – transition from unsustainability to sustainability – sustainable development goals (SDGs) – targets, indicators, and intervention areas – zero waste and R concepts – environmental impact assessment (EIA) – sustainable habitat – green buildings, green materials, sustainable transport.				
Activity Sustainability assessment of campus/community.				
L:45, SL:45, Total:90 Hours				
Weightage: Continuous Assessment 40% End Semester Examinations 60%				
REFERENCE BOOKS:				
1.	Anubha Kaushik and C. P. Kaushik’s “Perspectives in Environmental Studies”, 6th Edition, New Age International Publishers ,2018.			
2.	Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi 2016.			
3.	Gilbert M.Masters, ‘Introduction to Environmental Engineering and Science’, 2nd edition, Pearson Education, 2004.			
4.	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.			
5.	Rajagopalan, R, ‘Environmental Studies-From Crisis to Cure’, Oxford University Press, Third Edition, 2015.			
E-RESOURCES:				
1.	www.ePathshala.nic.in			
2.	www.onlinecourses.nptel.ac.in/			
3.	eGyanKosh – IGNOU Repository (http://egyankosh.ac.in)			
4.	https://www.unep.org			
5.	MIT OpenCourseWare (https://ocw.mit.edu)			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Explain the principles of ecology, biodiversity, environmental pollution, sustainable energy resources, climate change, and environmental sustainability.		---	---
CO2	Apply environmental concepts and scientific principles to analyze ecosystem functions, pollution problems, biodiversity conservation, and sustainable energy utilization.		PO1	---
CO3	Analyze environmental challenges by correlating ecological processes, pollution impacts, climate change effects, and sustainability indicators.		PO2, PO7	---
CO4	Assess renewable energy technologies, climate management strategies, environmental policies, and sustainability practices for engineering applications.		PO6, PO7	---

CO5	Perform environmental observations, field studies, sustainability assessments, and activity-based investigations, and interpret the results using scientific methods.	PO8	---
CO6	Engage in self-learning activities related to environmental management, biodiversity conservation, renewable energy, climate action, and sustainable development and communicate the findings effectively.	PO9, PO11	---

The Course Articulation Matrix (CAM) for defined COs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1														
CO2	3													
CO3		3					3							
CO4						2	2							
CO5								2						
CO6									2		2			

Activities:

1.	Conduct field-based and activity-oriented studies related to ecosystems, biodiversity, environmental pollution, renewable energy resources, climate change impacts, carbon footprint assessment, waste management, and sustainability practices, and prepare reports based on observations and findings. (CO5) (Individual and Collaborative Team Work)
2.	i) A comprehensive environmental impact assessment study on environmental sustainability, public welfare, regulatory compliance, and ethical responsibilities. (CO4) (Independent study) ii) Participate in self-learning activities such as seminars, case studies, quizzes, presentations, and literature reviews on environmental conservation, sustainable energy technologies, climate agreements, environmental legislation, SDGs, green buildings, and sustainable transportation systems. (CO6) (Independent study)

Rubrics for evaluation: CO4

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Environmental Sustainability Assessment	10	Comprehensive evaluation of environmental impacts and sustainability measures with strong supporting evidence.	Adequate evaluation of major environmental impacts and sustainability aspects.	Limited or incomplete assessment of environmental sustainability.
2.	Public Welfare and Societal Impact Analysis	5	Thorough analysis of impacts on public health, safety, and community welfare with clear justification.	Identifies key societal impacts with moderate analysis.	Limited discussion of public welfare and societal impacts.
3.	Regulatory Compliance Evaluation	5	Clearly assesses compliance with relevant environmental laws, regulations, and standards.	Addresses major regulatory requirements with some gaps.	Minimal or inaccurate assessment of regulatory compliance.
	Total	20			

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Understanding of Environmental Concepts	10	Demonstrates thorough understanding and accurate interpretation	Good understanding with minor gaps	Basic understanding
2.	Data Collection and Observation	10	Accurate, systematic, and comprehensive observations	Mostly accurate observations	Adequate observations
3.	Analysis and Interpretation	10	Excellent scientific analysis and interpretation	Good analysis with minor errors	Basic analysis
4.	Report / Presentation Quality	10	Clear, organized, and professional	Well organized with minor issues	Moderately organized
	Total	40			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good(2)	Satisfactory (1)
1.	Conceptual Clarity	10	Complete understanding and clarity	Good understanding	Moderate understanding
2.	Accuracy of Content	5	Scientifically accurate and comprehensive	Mostly accurate	Some inaccuracies
3.	Participation and Preparedness	5	Highly engaged and well prepared	Well prepared	Partially prepared
	Total	20			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
C01	12	12			12	2
C02	24	24			24	3
C03	24	24			24	3
C04				20	10	2
C05			40		20	2
C06				20	10	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength = 3 (if percentage >20%);
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26MCC04	DISASTER MANAGEMENT AND PREPAREDNESS		SEMESTER				IV	
Prerequisites			Category	MC	Credits			0
NIL			Hours/ Semester	L	T	P	SL	TH
				30	0	0	30	60
COURSEOBJECTIVES								
1.	To provide students an exposure to disasters, their significance and types.							
2.	To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction							
3.	To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)							
4.	To develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.							
5.	To critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.							
UNIT-I		INTRODUCTION TO DISASTERS						6
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc -Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability – Global trends in disasters : urban disasters, pandemics, complex emergencies, Climate change – Dos and Don'ts during various types of Disasters.								
UNIT-II		APPROACHES TO DISASTER RISK REDUCTION (DRR)						6
Disaster cycle- Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural – nonstructural measures, Roles and responsibilities of - community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake – holders – Institutional Processes and Frame work at State and Central Level – State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.								
UNIT-III		DISASTER RISK MANAGEMENT IN INDIA						6
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, and Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation–Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.								
UNIT-IV		DISASTE MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS						6
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, DroughtAssessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters : Case Studies, Space Based Inputs for Disaster Mitigation and Management and fieldworks related to disaster management.								
UNIT-V		DISASTER PREPAREDNESS AND MANAGEMENT						6
Disaster Preparedness Concepts - Preparedness:- Roles and Responsibilities – Preparedness for Relief and Rescue – Technology in Preparedness – Community Preparedness – Monitoring of Phenomena Triggering a Disaster or Hazard, Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports : Governmental and Case Studies for Preparedness.								
Total: 60 Hours								

Weightage: Continuous Assessment 100%			
REFERENCEBOOKS:			
1.	"Disaster Management:Risk,Response,Recovery" by Dr.RajLaxmi, Dr.AmitSinha(2025)		
2.	"Disaster Management" by ShaikhUbaid, 2020, First Edition, Technical Publications.		
3.	"Disaster Management" by K.SriramKumar, P.KrishnaSankar, S.Arunprasath - PUBLICATION: ARS		
4.	"Govt. of India: Disaster Management Act, Government of India", NewDelhi, 2025.		
5.	Government of India, National Disaster Management Policy,2023.		
E-RESOURCES:			
1.	National Disaster Management Authority (NDMA), Government of India		
2.	https://www.youtube.com/@ndmaindia		
3.	Disaster Management and Environmental Studies MOOCs.		
4.	National Institute of Disaster Management (NIDM)		
5.	YouTube: NIDM YouTube Channel		
COURSEOUTCOMES(COs)/ At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Explain the concepts of disasters, hazards, vulnerability, resilience, risk, and their impacts on society, economy, environment, and public health.	PO1	PO1
CO2	Apply disaster risk reduction (DRR) principles, disaster cycle concepts, and community-based approaches for disaster preparedness and mitigation.	PO2, PO6	PSO1
CO3	Analyze disaster risk management frame works, institutional mechanisms, and disaster policies in India for effective disaster response and recovery.	PO2, PO3, PO6	PSO2
CO4	Evaluate disaster case studies using GIS, remote sensing, early warning systems, and information technology tools for risk assessment and management.	PO4, PO5	PSO1
CO5	Conduct field studies, case studies, and self-learning activities related to natural and man-made disasters, and assess their societal, environmental, and economic impacts.	PO6, PO7, PO9, PO10	PSO2
CO6	Develop disaster preparedness and management strategies for communities by integrating technological tools, risk monitoring techniques, and sustainable disaster management practices.	PO3, PO5, PO6, PO9, PO10, PO11	PSO3

The Course Articulation Matrix (CAM) for defined COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	2	-	-	-	-	-	-	-	-
CO3	-	3	2	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	3	3	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	3	3	-	3	3	-	-	3	-
CO6	-	-	2	-	3	3	2	-	3	3	3	-	-	3

Activities:

1.	Activity 1 (CO5): Case Study/Field Work ➤ Flood Risk Assessment ➤ Landslide Hazard Mapping ➤ Cyclone Impact Assessment ➤ Forest Fire Analysis ➤ Disaster Relief Camp Evaluation
2.	Activity 2 (CO6): Technical Seminar/Mini Project ➤ Community Disaster Preparedness Plan ➤ GIS-based Disaster Mapping ➤ Early Warning System Design ➤ Disaster Response and Recovery Plan ➤ Campus Disaster Management Plan

Rubrics forevaluation:CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Problem formulation & boundary conditions	20	Problem and boundary conditions are clearly defined	Problem defined, but some of the boundary conditions are unclear	Problem statement defined but unclear boundary conditions
2.	Simulation & plots	30	Simulation is done and plots are well-presented	Simulation is done, but minor error in plots	Simulations and plots are incomplete
3.	Interpretation of results	25	Results are clearly Interpreted & justified	Results are interpreted but limited justification	Unclear interpretation
4.	Report presentation	25	Report is clear and well structured	Report is structured, but needs improvement	Poorly structured report
	Total	100			

Rubrics forevaluation:CO6

Sl. No.	Criterion	Marks	Excellent(3)	Good(2)	Satisfactory(1)
1.	Problem identification & case selection	20	Disaster case is clearly identified with relevant scope and boundary conditions defined	Case identified but boundary conditions are partially unclear	Case selection is unclear with weak problem definition
2.	Data collection & analysis	30	Relevant and sufficient data collected; clear analysis of hazard, vulnerability and impacts	Adequate data collected with minor gaps in analysis	Incomplete data collection and weak analysis
3.	Interpretation of disaster impacts	25	Clear interpretation of social, economic, environmental and health impacts with justification	Impacts interpreted but with limited justification	Poor or unclear interpretation of impacts
4.	Report presentation	25	Report is well-structured, clear and professionally presented	Report is structured but needs improvement	Poorly structured and unclear report
	Total	100			

The Internal Assessment Matrix (IAM) for the defined COs:

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	12	12	-	-	6	1
CO2	24	24			47	3
CO3	12	12			16	2
CO4	12	12			11	2
CO5	12	12	40		10	2
CO6				40	10	2
Total	60	60	40	40	100	

Note: Purely as an Example: Strength=3(ifpercentage>20%); Strength=2 (ifpercentage10%to20%); Strength =1(ifpercentage<10%);

26MCS03		DESIGN SPRINTS			SEMESTER			IV	
Prerequisites				Category	SD	Credits		0	
				Hours/ Semester	L	T	P	SL	TH
					0	0	15	15	30
COURSE OBJECTIVES									
1.	Develop key skill areas essential for a product designer from the perspective of design, its inherent complexity, and support them with tools and techniques for rapid prototyping.								
2.	Enable the participants to visualize and understand the user experience effectively.								
3.	Learn the roles and responsibilities of a designer in creating and shaping user experiences.								
4.	Understand how existing products and systems function through the principles of system thinking.								
5.	Select and apply various tools, techniques, and practices to support rapid prototyping and product development.								
UNIT - I		DESIGN FUNDAMENTALS							3
Introduction to Visual Design, History and Modernism, Design Thinking methodology, seven elements of design, principles of design, principles of good design, designing a product and a service.									
UNIT - II		SYSTEM THINKING AND REVERSE ENGINEERING							3
System Thinking for Engineering Problem Solving, Understanding Systems, Examples and understandings, Complex Systems, Reverse Engineering Methodology, Identify building blocks/Components - Re-Engineering a complex system									
UNIT - III		USER INTERFACE & USER EXPERIENCE							3
Introduction to UI/UX, Human-Computer interface, user-centered Design Principles, User research techniques, UX Design workflow, Information Architecture, UI Components, need for UI prototyping, Wireframes.									
UNIT - IV		MECHANICAL PROTOTYPING							3
Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Introduction - Working with Fusion 360 - 3D Modeling - 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing.									
UNIT - V		ELECTRONIC & SOFTWARE PROTOTYPING							3
Introduction to Lumped Circuits - Electronic Prototyping - Tinker CAD - Designing in KI CAD - PCB design - Source code management and version control - GitHub - GitHub Actions - GitBash - Continuous Integration - Platform as service - Heroku - Build Packs.									
P:15,SL:15, Total:30 Hours									
Weightage:									
Continuous Assessment 100%									

REFERENCE BOOKS:														
1.	Thinking in Systems – Donella Meadows, 2015.													
2.	Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development – Frank W. Liou, 2007.													
3.	Rapid Prototyping Technology: Selection and Application – Cooper K. G., 2001.													
4.	Introduction to Systems Thinking – https://thesystemsthinker.com/wp-content/uploads/2016/03/Introduction-to-Systems-Thinking-IMS013Epk.pdf													
5.	Ultimate Guide to Prototyping Tools for Hardware and Product Design – https://formlabs.com/blog/ultimate-guide-to-prototyping-tools-for-hardware-and-product-design/													
E-RESOURCES:														
1.	Introduction to Systems Thinking https://thesystemsthinker.com/wp-content/uploads/2016/03/Introduction-to-Systems-Thinking-IMS013Epk.pdf													
2.	Ultimate Guide to Prototyping Tools for Hardware and Product Design https://formlabs.com/blog/ultimate-guide-to-prototyping-tools-for-hardware-and-product-design/													
3.	KiCad Documentation https://docs.kicad-pcb.org/													
4.	Tinkercad Circuits Learning Resources https://www.tinkercad.com/learn/circuits													
5.	GitHub Actions Documentation https://docs.github.com/en/actions													
6.	GitHub Actions Guides https://docs.github.com/en/free-pro-team@latest/actions/guides													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to										Mapping POs		Mapping PSOs		
CO1	Understand the elements and principles of product and service design.									PO9, PO11		-		
CO2	Apply system thinking concepts in reverse engineering.									PO2, PO9		PSO1		
CO3	Apply user research techniques to meet the UX needs of a customer and design a visual prototype.									PO5, PO9, PO10		PSO1		
CO4	Develop prototyping models using the tools from mechanical prototyping methods.									PO3, PO5, PO9		PSO2		
CO5	Develop prototyping models using the tools from electrical and software prototyping methods.									PO3, PO5, PO9		PSO2		
CO6	Demonstrate design thinking, problem-solving, teamwork, and innovation skills in developing user-centric product prototypes.									PO8, PO9, PO10, PO11		PSO3		
The Course Articulation Matrix (CAM) for defined Cos														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO01	PSO02	PSO03
CO1		-	-	-	-	-	-	-	3	-	2	-	-	-
CO2	-	3	-	-	-	-	-	-	3	-	-	3	-	-
CO3	-	-	-	-	3	-	-	-	3	2	-	2	-	-
CO4	-	-	3	-	3	-	-	-	2	-	-	-	3	-
CO5	-	-	3	-	3	-	-	-	2	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	3	2	2	-	-	3

Activities:

1.	Activity 1: Design Research and Concept Development Sprint Observe and analyze existing products and systems, identify user needs through surveys and interviews, apply design principles, system thinking, and reverse engineering concepts, develop user personas, journey maps, sketches, and wireframes, generate and evaluate design alternatives, select suitable solutions, document findings, and present the proposed design concept.
2.	Activity 2: Prototype Development and Design Sprint Showcase Create CAD models and prototypes, integrate mechanical, electronic, and software components, conduct testing and validation activities, evaluate performance, collect feedback and refine the prototype, document development and testing processes, demonstrate the developed prototype, present project outcomes, and showcase innovation, teamwork, and problem-solving skills.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Prototype Design and Development	25	Develops a complete and functional electronic/software prototype meeting all requirements	Develops a functional prototype with minor limitations	Develops a basic prototype with significant limitations
2.	Application of Tools and Technologies	25	Effectively utilizes prototyping tools, software platforms, and design techniques	Utilizes tools appropriately with minor errors	Demonstrates limited proficiency in using tools and technologies
3.	Testing, Validation, and Documentation	25	Performs comprehensive testing, validation, and provides detailed documentation	Performs adequate testing and documentation with minor gaps	Limited testing and incomplete documentation
4.	Innovation, Presentation, and Demonstration	25	Demonstrates innovative features and presents the prototype effectively with clear explanations	Demonstrates useful features and presents satisfactorily	Limited innovation and ineffective presentation of the prototype
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Design Thinking and Problem Solving	25	Demonstrates a thorough understanding of user needs and develops innovative solutions effectively	Demonstrates good understanding with minor gaps in problem-solving	Demonstrates basic understanding with limited problem-solving ability

2.	Teamwork and Collaboration	25	Actively contributes, collaborates effectively, and supports team objectives	Participates well with minor collaboration issues	Participates minimally with limited teamwork
3.	Innovation and Creativity	25	Demonstrates highly innovative ideas and creative approaches in product development	Demonstrates good innovation with moderate creativity	Demonstrates limited innovation and creativity
4.	Prototype Demonstration and Communication	25	Clearly demonstrates the prototype and communicates ideas confidently and effectively	Demonstrates the prototype adequately with minor communication issues	Demonstrates limited communication skills and ineffective prototype presentation
	Total	100			