



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. Computer Science and 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	5					23
III	3			17				3	23
IV	3			16			1	3	23
V		2		15	3		1		21
VI				7	9	3	3		22
VII				16	6				22
VIII							10		10
Total	25	8	12	76	18	3	17	6	165
% of Category	15.15	4.85	7.27	46.06	10.91	1.82	10.30	3.64	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.	26HMC01	Heritage of Tamils / தமிழர் மரபு	T	15	0	0	15	30	1	HM	40	60	100
4.	26PHC01	Applied Physics	LIT	45	0	45	30	120	4	BS	50	50	100
5.	26CYC01	Applied Chemistry	LIT	45	0	45	30	120	4	BS	50	50	100
6.	26CSC01	C Programming	LIT	45	0	30	45	120	4	ES(G)	50	50	100
7.	26MEC02	Engineering Practices Laboratory	L	0	0	45	15	60	2	SD	60	40	100
8.	26MCC01	Induction Programme	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.	26MAC03	Linear Algebra and Numerical Methods	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.	26CSC02	Object Oriented Programming using C++	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26EEC01	Basic Electrical and Electronics Engineering	LIT	45	0	45	30	120	4	ES(G)	50	50	100
5.	26MEC01	Engineering Graphics	T	30	45	0	45	120	4	ES(G)	40	60	100
6.	26HMC02	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	T	15	0	0	15	30	1	HM	40	60	100
7.	26PHC02	Materials Science	T	45	0	0	45	90	3	BS	40	60	100
8.	26CSC03	Object Oriented Programming using C++ Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
9.	26MCS01	Engineering Sprints	L	0	0	15	15	30	0	SD	100	-	100
10.	26NCC01	NCC Course – I*	T	30	0	0	30	60	2*	-	40	60	100
Total								780	23				

*< 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.	26MA301	Probability and Statistics	T	45	15	0	30	90	3	BS	40	60	100
2.	26CSC04	Computer Architecture	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26CSC05	Java Programming	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26CSC06	Data Structures and Algorithms	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26CSC07	Operating Systems	LIT	45	0	30	45	120	4	ES(PC)	50	50	100
6.	26CSC08	Java Programming Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
7.	26CSC09	Data Structures and Algorithms 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								780	23				

*< 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.	26MAC06	Discrete Mathematics	T	45	15	0	30	90	3	BS	40	60	100
2.	26CSC10	Design and Analysis of Algorithms	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26CS401	Theory of Computation	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26CSC11	Python for Data Science	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26CSC12	Database Management Systems	T	45	0	0	45	90	3	ES(PC)	40	60	100
6.	26CSC14	Database Management Systems Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
7.	26CSC15	Python for Data Science Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
8.	26MCC02	Environmental Science and Engineering	T	45	0	0	45	90	3	MC	40	60	100
9.	26CSICXX	Industry Oriented Course - I	IOC	15	0	0	15	30	1	SD	100	-	100
10.	26MCC04	Disaster Management and Preparedness	T	30	0	0	30	60	0	MC	100	-	100
11.	26MCS03	Design Sprints	L	0	0	15	15	30	0	SD	100	-	100
Total								780	23				

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.	26CSC13	Artificial Intelligence	T	45	0	0	45	90	3	ES(PC)	40	60	100
2.	26CSC16	Computer Networks	LIT	45	0	30	45	120	4	ES(PC)	50	50	100
3.	26CS501	Principles of Compiler Design	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26CSC17	Machine Learning	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26CSPEXX	Programme Elective - I	T	45	0	0	45	90	3	ES(PE)	40	60	100
6.	26CSC18	Artificial Intelligence and Machine Learning Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
7.	26ENC03	Placement and Soft Skills Laboratory	L	0	0	45	15	60	2	HM	60	40	100
8.	26CSICXX	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.	26CSD01	Capstone Design Project Level-I	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26CSHXX	Honours Elective - I	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26CSHXX	Honours Elective - II	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26CSMXX	Minor Elective - I	T	45	0	0	45	90	3	OE	40	60	100
2.	26CSMXX	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.	26CSC19	Object Oriented Software Engineering	T	45	0	0	45	90	3	ES(PC)	40	60	100
2.	26CS601	Cryptography and Cyber Security	LIT	45	0	30	45	120	4	ES(PC)	50	50	100
3.	26CSPEXX	Programme Elective - II	T	45	0	0	45	90	3	ES(PE)	40	60	100
4.	26CSPEXX	Programme Elective - III	T	45	0	0	45	90	3	ES(PE)	40	60	100
5.	26CSPEXX	Programme Elective - IV	T	45	0	0	45	90	3	ES(PE)	40	60	100
6.	26XXOEEXX	Open Elective - I	T	45	0	0	45	90	3	OE	40	60	100
7.	26CS602	Mini Project	PW	0	0	45	45	90	3	SD	100	-	100
Total								660	22				

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.	26CSD02	Capstone Design Project Level-II	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26CSHXX	Honours Elective - III	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26CSHXX	Honours Elective - IV	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26CSMXX	Minor Elective - III	T	45	0	0	45	90	3	OE	40	60	100
2.	26CSMXX	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.	26CSC20	Full Stack Development	T	45	0	0	45	90	3	ES(PC)	40	60	100
2.	26CSC21	Deep Learning	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26CSC22	Principles of Management	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26CS701	Mobile Application Development	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26CSPEXX	Programme Elective - V	T	45	0	0	45	90	3	ES(PE)	40	60	100
6.	26CSPEXX	Programme Elective - VI	T	45	0	0	45	90	3	ES(PE)	40	60	100
7.	26CS702	Mobile Application Development Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
8.	26CSC23	Full Stack Development Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
Total								660	22				

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.	26CSD03	Capstone Design Project Level-III	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26CSHXX	Honours Elective - V	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26CSHXX	Honours Elective - VI	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26CSMXX	Minor Elective - V	T	45	0	0	45	90	3	OE	40	60	100
2.	26CSMXX	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.	26CS801	Project Work	PW	0	0	225	75	300	10	SD	60	40	100
Total								300	10				
Total Credits of the Programmes									165				

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													
1.	26CSPEC01	Cloud Computing	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26CSPEC02	Design Thinking and Innovation	T	45	0	0	45	90	3	ES(PE)	40	60	100
3.	26CSPE01	Blockchain Technologies	T	45	0	0	45	90	3	ES(PE)	40	60	100
4.	26CSPE02	Computer Hardware and Troubleshooting	T	45	0	0	45	90	3	ES(PE)	40	60	100
5.	26CSPE03	Digital Twin Technologies and Immersive Simulation	T	45	0	0	45	90	3	ES(PE)	40	60	100
Programme Elective - II													
6.	26CSPEC03	Augmented Reality/ Virtual Reality	T	45	0	0	45	90	3	ES(PE)	40	60	100
7.	26CSPEC04	UI and UX Design and Human-Centered Design	T	45	0	0	45	90	3	ES(PE)	40	60	100
8.	26CSPE04	Information Retrieval Techniques	T	45	0	0	45	90	3	ES(PE)	40	60	100
9.	26CSPE05	Brain–Computer Interface and Cognitive Systems	T	45	0	0	45	90	3	ES(PE)	40	60	100
10.	26CSPE06	Computational Neuro Science	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)	40	60	100

Programme Elective - III													
12.	26CSPEC05	Edge and Fog Computing	T	45	0	0	45	90	3	ES(PE)	40	60	100
13.	26CSPEC06	Java Springboot	T	45	0	0	45	90	3	ES(PE)	40	60	100
14.	26CSPE07	Advanced Java Programming	T	45	0	0	45	90	3	ES(PE)	40	60	100
15.	26CSPE08	Graph Theory	T	45	0	0	45	90	3	ES(PE)	40	60	100
16.	26CSPE09	Data Mining and Warehousing	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)	40	60	100
Programme Elective - IV													
18.	26CSPEC07	Granular Computing	T	45	0	0	45	90	3	ES(PE)	40	60	100
19.	26CSPEC08	DevOps	T	45	0	0	45	90	3	ES(PE)	40	60	100
20.	26CSPE10	High Performance Computing	T	45	0	0	45	90	3	ES(PE)	40	60	100
21.	26CSPE11	No SQL Databases	T	45	0	0	45	90	3	ES(PE)	40	60	100
22.	26CSPE12	Statistical Inference	T	45	0	0	45	90	3	ES(PE)	40	60	100
Programme Elective - V													
23.	26CSPEC09	Quantum Computing	T	45	0	0	45	90	3	ES(PE)	40	60	100
24.	26CSPEC10	Business Intelligence and its Applications	T	45	0	0	45	90	3	ES(PE)	40	60	100
25.	26CSPE13	Robotics and Automation	T	45	0	0	45	90	3	ES(PE)	40	60	100
26.	26CSPE14	Computer Vision	T	45	0	0	45	90	3	ES(PE)	40	60	100
27.	26CSPE15	Soft Computing	T	45	0	0	45	90	3	ES(PE)	40	60	100
Programme Elective - VI													
28.	26CSPEC11	Dynamic Paradigm for IoT	T	45	0	0	45	90	3	ES(PE)	40	60	100
29.	26CSPEC12	Smart IoT Architecture	T	45	0	0	45	90	3	ES(PE)	40	60	100
30.	26CSPE16	Data Privacy	T	45	0	0	45	90	3	ES(PE)	40	60	100
31.	26CSPE17	Public Key Infrastructure and Trust Management	T	45	0	0	45	90	3	ES(PE)	40	60	100
32.	26CSPE18	Digital Watermarking and Steganography	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.	26CSH01	Generative AI and Prompt Engineering
2.	26CSH02	Explainable AI (XAI) and Trustworthy Machine Learning
3.	26CSH03	Programming for Data Science
4.	26CSH04	Big Data Analytics
5.	26CSH05	Image and Video Analytics
6.	26CSH06	Text and Speech Analytics
7.	26CSH07	Predictive Analytics
8.	26CSH08	Information Security
9.	26CSH09	Web and IoT Security
10.	26CSH10	Malware Analysis

List of Minors Courses

Sl. No.	Course Code	Course Name
1.	26CSM01	Programming in C++
2.	26CSM02	Introduction to Data Structures and Algorithms
3.	26CSM03	Computer Organization
4.	26CSM04	Operating System Concepts
5.	26CSM05	Fundamentals of Computer Networks
6.	26CSM06	Programming Essentials in Python
7.	26CSM07	Database System Concepts
8.	26CSM08	Cloud Technologies Fundamentals
9.	26CSM09	Foundations of Artificial Intelligence
10.	26CSM10	Digital and Mobile Forensics

26MAC01	MATRICES AND CALCULUS B.E. (Common to all Branches Except EEE)		SEMESTER				I
Prerequisites		Category	BS	Credits			4
		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, 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, PSO2

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	PSO1, PSO2
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	PSO2
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	--
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	PSO2

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	3	
C03		2										2	2	
C04			1										1	
C05										3				
C06					3								2	
Avg	3	2	1		3					3		2.5	2	

Activities:

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

1.	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.
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2.	Computational Exploration of Matrices, Multiple Integrals, and Vector Fields using Software (CO6) 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.
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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 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	-	20	2
CO6	-	-	-	40	20	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%);

26ENC01	COMMUNICATIVE ENGLISH B.E. (Common to all Branches)		SEMESTER			I	
Prerequisites		Category	HM	Credits		2	
NIL		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	INTERPRETATION	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%		
TEXT BOOKS:		
1.	Sharma, S., and B. Mishra. Communication Skills for Engineers and Scientists. 2nd ed., PHI Learning, 2024.	
2.	Miller, Katherine Q., and Susan T. Wahl. Business and Professional Communication: KEYS for Workplace Excellence. 5th ed., SAGE Publications, 2023.	
REFERENCE BOOKS:		
1.	Viswamohan, Aysha. English for Technical Communication. McGraw-Hill Education, 2013.	
2.	Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principles and Practice. 3rd ed., Oxford University Press, 2015.	
3.	Rizvi, M. Ashraf. Effective Technical Communication. 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	PSO3
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
CO6	Integrate communication, interpersonal, and leadership skills in real-life and workplace situations while demonstrating ethical, social, and professional responsibility.	PO8, PO9, PO11	PSO3

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									3		2			
CO2									3		2			
CO3									3		2			2
CO4									3		2			
CO5									3	2	2			2
CO6								2	3		2			2

Activities:

1.	CO5: Develop professional writing skills for drafting reports, emails, proposals, status reports, feasibility reports, and other workplace documents.
	(i) Technical Report Writing Project: Prepare a detailed technical report based on a case study, industrial visit, survey, or mini project including abstract, findings, analysis, and recommendations.
	(ii) Business Proposal Development: Design and present a professional proposal for a startup idea, product launch, campus initiative, or technical solution addressing real-world problems.
	(iii) Workplace Email: Draft formal emails, circulars, notices for different workplace situations such as complaints, negotiations, approvals, and scheduling.
	(iv) Feasibility and Status Report Preparation: Analyze a technical or business scenario and prepare feasibility reports and periodic status reports using charts, data interpretation, and recommendations.
	(v) Collaborative Documentation Activity: Work in teams to create project documentation including meeting minutes, progress reports, executive summaries, and client communication records.

2.	CO6: Integrate communication, interpersonal, and leadership skills in real-life and workplace situations while demonstrating ethical, social, and professional responsibility.				
	(i) Group Discussion and Leadership Role Play:	Participate in team-based discussions where students rotate as leader, moderator, presenter, and evaluator to solve workplace problems.			
	(ii) Mock Interview and HR Interaction	Attend simulated HR, technical, and panel interviews focusing on communication, confidence, interpersonal behaviour, and professional ethics.			
	(iii) Corporate Meeting Simulation:	Conduct formal meetings involving agenda preparation, negotiation, conflict resolution, decision-making, and presentation of outcomes.			
	(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.			

Rubrics for evaluation: CO5

Sl. No.	Criterion	Mark	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Understanding of Purpose and Audience	8	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	8	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	8	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	8	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
5.	Use of Supporting Details and Evidence	8	Includes relevant facts, examples, data, or justifications that effectively support the purpose of the document	Includes some supporting details, though not always fully developed or relevant	Supporting details are insufficient, unclear, or largely absent
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Mark	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Communication Skills	8	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	8	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	8	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	8	Consistently demonstrates ethical behavior, professionalism, accountability, and social responsibility	Demonstrates responsibility, professionalism with minor lapses	Shows inadequate awareness of ethical or professional responsibilities
5.	Adaptability and Professional Conduct	8	Demonstrates flexibility, confidence, and professionalism in diverse workplace situations	Adapts to most situations with minor support and maintains professional conduct	Shows difficulty adapting to new situations and exhibits inconsistent professional behavior
	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: Strength = 3 (if percentage >20%);

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

26HMC01		தமிழர் மரபு B.E. - அனைத்து துறைகளுக்கும் பொதுவானது		பருவம்		I	
முன்தேவைகள்		Category		HM		Credits	
இலக்கணம் மற்றும் இலக்கியத்தின் அடிப்படைகள்		Hours/ Semester		L		T	
				15		0	
				0		15	
				15		30	
பாட நோக்கங்கள்							
1.		தமிழ் மொழி மற்றும் இலக்கியம் பற்றிய அறிவைப் பெற முடியும்.					
2.		பாரம்பரியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் மற்றும் சிற்பக் கலைகள் பற்றி தெரிந்து கொள்ள முடியும்.					
3.		நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் பற்றி அறிந்து கொள்ள முடியும்.					
4.		தமிழர்களின் ஒழுக்க நெறிமுறைகளைப் பற்றி தெரிந்து கொண்டு அதன்படி நடந்து கொள்ள முடியும்.					
5.		பழங்கால இந்திய தேசிய இயக்கம் பற்றியும், இந்திய மக்களின் பண்பாட்டில் தமிழர்களின் பங்களிப்பு பற்றியும் நன்கு அறிந்து கொள்ள முடியும்.					
அலகு - I		மொழி மற்றும் இலக்கியம்:					3
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் -சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர் தல் அறம் - திருக்குறளில் மேலாண்மை கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த 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 - சிற்பக் கலை					3
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள் , பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம் , பறை, வீணை, யாழ் , நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.							
அலகு - III		நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்					3
தெருக்கூத்து, கரகாட்டம் , வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம் , தமிழர்களின் விளையாட்டுகள்.							
அலகு - IV		தமிழர்களின் திணைக் கோட்பாடுகள்					3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கொப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு -சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர் களின் 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 அச்ச வரலாறு.							
L:15, SL:15, Total:30 Hours							

மதிப்பீட்டு விவரம்: தொடர் மதிப்பீடு: 40% பருவ இறுதித் தேர்வுகள்: 60%			
குறிப்பு நூல்கள்:			
1.	தமிழக வரலாறு – மக்களும் பண்பாடும்- கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)		
2.	கணினித் தமிழ்- முனைவர் இல. சுந்தரம்(விகடன் பிரசுரம்)		
3.	கீழடி- வைகை நதிகரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)		
4.	பொருளை- ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு)		
மின்னணு வளங்கள்:			
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/		
பாடநெறி முடிவுகள் (COs) / இந்தப் படிப்பு முடிந்ததும், மாணவர்களால்		Mapping POs	Mapping PSOs
CO1	இந்திய மொழிகள், மொழிக் குடும்பங்கள், 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.	PO1, PO9	-
CO3	தமிழர்களின் வாழ்வியல் முறைகளோடு தொடர்புடைய நாட்டுப்புறக் கலைகள், வீர விளையாட்டுகள் மற்றும் சங்ககாலத் திணைக் கோட்பாடுகளைப் புரிந்துகொண்டு அவற்றின் பண்பாட்டு முக்கியத்துவத்தை எடுத்துரைப்பார்கள்.	PO9	PSO1
CO4	இந்திய தேசிய இயக்கத்திலும் இந்தியப் பண்பாட்டு வளர்ச்சியிலும் தமிழர்களின் பங்களிப்பை ஆய்ந்து அதன் வரலாற்றுச் சிறப்பை விளக்குவார்கள்.	PO2, PO9	
CO5	இந்திய மொழிகள், இலக்கிய வளர்ச்சி, தமிழ் இலக்கிய அறிஞர்களின் பங்களிப்புகள், சங்ககாலத் திணைக் கோட்பாடுகள் ஆகியவற்றை அடிப்படையாகக் கொண்டு கருத்தரங்குகள், விளக்கவுரைகள், குழு விவாதங்கள் மற்றும் திட்டப்பணிகளை மேற்கொண்டு தங்களது பகுப்பாய்வுத் திறனை வெளிப்படுத்துவார்கள்.	PO9, PO10	PSO3
CO6	தமிழர்களின் கலை, பண்பாடு, நாட்டுப்புறக் கலைகள், வீர விளையாட்டுகள், கோவில் மரபுகள் மற்றும் தேசிய இயக்கத்தில் தமிழர்களின் பங்களிப்பு தொடர்பான களஆய்வு, ஆவணப்படுத்தல், படைப்பாற்றல் செயல்பாடுகள் மற்றும் வழங்கல்களின் மூலம் பண்பாட்டு விழிப்புணர்வு மற்றும் ஆய்வுத் திறன்களை வளர்த்துக் கொள்வார்கள்.	PO8, PO9, PO10	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									3					
CO2									3					
CO3									3			2		
CO4									3					
CO5									3		2			2
CO6									3		2			2

Activities:

1.	CO5: தமிழர்களின் பாரம்பரிய அறிவியல் அறிவு, தொழில்நுட்பச் சாதனைகள் மற்றும் பண்பாட்டு மரபுகளை ஆராய்ந்து, அவற்றின் வரலாற்று மற்றும் தற்கால முக்கியத்துவத்தைப் புரிந்துகொள்வார்கள். செயல்பாடுகள்: - பழந்தமிழர்களின் அறிவியல் மற்றும் தொழில்நுட்பச் சாதனைகள் (எ.கா., நீர்ப்பாசன அமைப்புகள், கட்டிடக்கலை, உலோகவியல், கடல்சார் வாணிபம் (குறித்த கருத்தரங்கு வழங்கல்). - பாரம்பரியத் தமிழ் அறிவு முறைகளின் தற்காலப் பயன்பாடு மற்றும் முக்கியத்துவம் குறித்த குழு விவாதம். - தமிழர் பண்பாட்டு மரபுச் சின்னங்கள், வரலாற்று நினைவுச் சின்னங்கள் மற்றும் பொறியியல் அற்புதங்கள் தொடர்பான வழக்குக் கள ஆய்வு (Case Study Analysis). - தமிழர் நாகரிகம், அறிவியல் மற்றும் பண்பாடு தொடர்பான ஆவணப்படங்களைப் பார்த்து விமர்சன அறிக்கை (Review Report) தயாரித்தல். - தமிழர்களின் பண்பாட்டு மற்றும் தொழில்நுட்பப் பங்களிப்புகளை எடுத்துக்காட்டும் வகையில் விளக்கப்படங்கள், மாதிரிகள் மற்றும் புகைப்படங்களைக் கொண்டு பாரம்பரியக் கண்காட்சி நடத்துதல். - தமிழர் இலக்கியம், அறிவியல் மற்றும் பண்பாட்டுச் சாதனைகள் குறித்த வினாடி வினா மற்றும் பட்டிமன்றம் / விவாதம் நடத்துதல். - அருங்காட்சியகங்கள், பாரம்பரியத் தளங்கள், கோவில்கள் அல்லது தொல்லியல் தளங்களுக்கு களப்பயணம் மேற்கொண்டு ஆய்வறிக்கை சமர்ப்பித்தல்.
2.	CO6: தமிழர்களின் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டுப் பங்களிப்புகளின் பயன்பாடுகளையும் அவற்றின் தற்காலப் பொருத்தத்தையும் செயல்வழிக் கற்றல், வழக்குக் கள ஆய்வுகள் மற்றும் திட்டப்பணிகள் மூலம் வெளிப்படுத்துவார்கள். செயல்பாடுகள்: - தமிழர்களின் பாரம்பரியத் தொழில்நுட்பங்கள் (நீர் மேலாண்மை, வேளாண் முறைகள், பாரம்பரியக் கட்டிடக்கலை போன்றவை தொடர்பான சிறு திட்டப்பணி (Mini Project) மேற்கொள்ளுதல். - தமிழர் பொறியியல் சாதனைகளை (எ.கா., கல்லணை, கோவில் கட்டிடக்கலை, பண்டைய கடற்படைக் கப்பல்கள் (விளக்கும் மாதிரி வடிவமைத்தல் (Model Making Activity)). - பாரம்பரியத் தமிழ் அறிவு முறைகளின் தற்காலப் பயன்பாடுகள் குறித்த திட்ட அறிக்கை (Project Report) தயாரித்தல். - பண்டைய தமிழர் தொழில்நுட்பங்களையும் நவீன தொழில்நுட்பங்களையும் ஒப்பிட்டு வழக்குக் கள ஆய்வு வழங்கல் (Case Study Presentation) மேற்கொள்ளுதல்.

	5. பாரம்பரியக் கலைகள், கைவினைப் பொருட்கள், நாட்டுப்புற நடைமுறைகள் அல்லது பூர்வீகத் தொழில்நுட்பங்கள் தொடர்பான செயல்விளக்கக் காட்சி (Practical Demonstration) நடத்துதல். 6. தமிழர்களின் அறிவியல் மற்றும் தொழில்நுட்பப் பங்களிப்புகளை எடுத்துரைக்கும் சுவரொட்டி (Poster) மற்றும் தகவல் விளக்கப்படம் (Infographic) தயாரித்தல். 7. உள்ளூர் பாரம்பரிய அறிவு, நாட்டுப்புறப் பழக்கவழக்கங்கள் அல்லது பண்பாட்டு மரபுகள் தொடர்பான சமூக அடிப்படையிலான ஆய்வுத் திட்டம் மேற்கொண்டு அதன் முடிவுகளை வழங்குதல். 8. தமிழர் பாரம்பரியம் மற்றும் தொழில்நுட்பம் தொடர்பான திட்டப்பணிகள், புகைப்படங்கள், அறிக்கைகள் மற்றும் கற்றல் பிரதிபலிப்புகளை உள்ளடக்கிய மின்னணுத் தொகுப்பு (Digital Portfolio) உருவாக்குதல்.
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Rubrics for evaluation (மதிப்பீட்டு அளவுகோல்கள்): C05

வரி சை எண்	அளவுகோல்	மதிப் பெண்கள்	சிறப்பு (9–10)	நல்லது (6–8)	திருப்திகரமானது (1–5)
1.	தமிழ் பாரம்பரிய அறிவு	88	தமிழர்களின் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டு மரபுகள் குறித்து துல்லியமான விவரங்களுடன் விரிவான புரிதலை வெளிப்படுத்துகிறார்.	சிறிய குறைபாடுகளுடன் நல்ல புரிதலை வெளிப்படுத்துகிறார்.	வரையறுக்கப்பட்ட விவரங்களுடன் அடிப்படைப் புரிதலை வெளிப்படுத்துகிறார்.
2.	வரலாற்றுப் புரிதல்	8	வரலாற்றுப் பின்னணி மற்றும் அதன் முக்கியத்துவத்தை பொருத்தமான எடுத்துக்காட்டுகளுடன் தெளிவாக விளக்குகிறார்..	சில எடுத்துக்காட்டுகளுடன் வரலாற்றுப் பின்னணியை விளக்குகிறார்.	வரலாற்றுப் பின்னணியை குறைந்த அளவில் விளக்குகிறார்.
3.	தற்காலப் பொருத்தம்	8	பாரம்பரிய அறிவு மற்றும் சாதனைகளை இன்றைய பயன்பாடுகள் மற்றும் பிரச்சினைகளுடன் திறம்பட தொடர்புபடுத்துகிறார்.	பாரம்பரிய அறிவை நவீன பயன்பாடுகளுடன் ஓரளவு தெளிவாக தொடர்புபடுத்துகிறார்.	சில நவீன தொடர்புகளை மட்டுமே அடையாளம் காண்கிறார்.
4.	வழங்கல் மற்றும் தொடர்புத் திறன்	8	தகவல்கள் சிறப்பாக ஒழுங்கமைக்கப்பட்டு, தெளிவாகவும் சுவாரஸ்யமாகவும் பொருத்தமான ஆதாரங்களுடன் வழங்கப்படுகின்றன.	தகவல்கள் ஒழுங்கமைக்கப்பட்டு பெரும்பாலும் தெளிவாக வழங்கப்படுகின்றன.	தகவல்கள் புரிந்துகொள்ளக்கூடியதாக இருந்தாலும் தெளிவு மற்றும் ஒழுங்கமைப்பு குறைவாக உள்ளது.

5.	தொடர்புத் திறன்	8	கருத்துகள் தெளிவாகவும், தன்னம்பிக்கையுடனும், ஈர்க்கக்கூடிய வகையிலும், பொருத்தமான ஆதாரங்களுடன் வெளிப்படுத்தப்படுகின்றன	கருத்துகள் தெளிவாகவும், மிதமான தன்னம்பிக்கையுடனும், போதுமான ஆதாரங்களுடனும் வெளிப்படுத்தப்படுகின்றன	கருத்துப் பரிமாற்றம் புரிந்துகொள்ளக்கூடியதாக இருந்தாலும், தெளிவு, தன்னம்பிக்கை அல்லது பொருத்தமான ஆதாரங்களின் குறைபாடு காணப்படுகிறது
	மொத்தம்	40			

Rubrics for evaluation (மதிப்பீட்டு அளவுகோல்கள்): C06

வரிசை எண்	அளவுகோல்	மதிப் பெண்கள்	சிறப்பு (9–10)	நல்லது (6–8)	திருப்திகரமானது (1–5)
1.	அறிவின் பயன்பாடு	8	தமிழர்களின் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டுக் கருத்துக்களை செயல்வழிப் பணிகள் மற்றும் திட்டங்களில் திறம்படப் பயன்படுத்துகிறார்.	கருத்துக்களை சிறிய வழிகாட்டுதலுடன் சரியாகப் பயன்படுத்துகிறார்.	கருத்துக்களை அடிப்படை அளவில் மட்டுமே பயன்படுத்துகிறார்.
2.	திட்ட செயல்படுத்தல்	8	திட்டப்பணி முழுமையானதாகவும்கூட, புதுமையானதாகவும்கூட, சிறந்த திட்டமிடலுடன் வெற்றிகரமாக நிறைவேற்றப்பட்டதாகவும் உள்ளது.	திட்டப்பணி சிறிய குறைபாடுகளுடன் நன்கு செயல்படுத்தப்பட்டுள்ளது.	திட்டப்பணி குறைந்தபட்ச தேவைகளைப் பூர்த்தி செய்கிறது; ஆனால் ஆழமும் முழுமையும் குறைவாக உள்ளன.
3.	ஆதாரங்கள் மற்றும் வளங்களின் பயன்பாடு	8	திட்டத்தின் முடிவுகளை ஆதரிக்க பொருத்தமான தரவுகள், ஆதாரங்கள் மற்றும் எடுத்துக்காட்டுகளை திறம்படப் பயன்படுத்துகிறார்.	போதுமான ஆதாரங்களுடன் பொருத்தமான வளங்களைப் பயன்படுத்துகிறார்.	குறைந்த அளவிலான ஆதாரங்கள் மற்றும் வளங்களைப் பயன்படுத்துகிறார்.
4.	வழங்கல் திறன்	8	முடிவுகளைத் தெளிவாகவும் தொழில்முறை முறையிலும் சிறப்பான ஆவணப்படுத்தலுடன் வழங்குகிறார்.	நல்ல ஆவணப்படுத்தலுடன் தெளிவாக வழங்குகிறார்.	வழங்கல் மற்றும் ஆவணப்படுத்தல் போதுமானதாக இருந்தாலும் தெளிவும் விவரங்களும் குறைவாக உள்ளன.

5.	ஆவணப்படுத்தல் தரம்	8	ஆவணப்படுத்தல் முழுமையானதாகவு ம், துல்லியமானதாகவு ம், நன்கு ஒழுங்கமைக்கப்பட் டதாகவும், சரியான வடிவமைப்புடன் அமைந்ததாகவும் உள்ளது.	ஆவணப்படுத்தல் முழுமையாகவும், சிறிய விடுபாடுகளுடன் ஒழுங்கமைக்கப்பட் டதாகவும் 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
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%);

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%							

TEXT 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.													
REFERENCE BOOKS:														
1.	"Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Publications, Tamil Nadu.													
2.	"Keeladi-Sangam City Civilization on the banks of river Vaigai", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Publications, Tamil Nadu.													
3.	"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 Thina 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	PO 9	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: 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. Documentary Viewing and Review on Tamil civilization, science, and culture. 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.	CO6: 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). Project Report Preparation on the modern applications of traditional Tamil knowledge systems. Case Study Presentation comparing ancient Tamil technologies with contemporary technologies. Practical Demonstration of traditional arts, crafts, folk practices, or indigenous techniques. Poster and Infographic Creation highlighting Tamil scientific and technological contributions. 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: CO5

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: C06

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
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: Strength = 3 (if percentage $\geq 20\%$);

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

26PHC01	APPLIED PHYSICS				SEMESTER				I	
Prerequisites					Category	BS	Credits			4
NIL					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 lasers.									
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 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 lasers – Construction and working of Nd:YAG laser, CO ₂ 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 BOOK:		
1.	A. Marikani, 'Engineering Physics', PHI Learning Publishers,2024.	
2.	M.Arumugam, 'Engineering Physics', AnuradhaPublications,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	P10	P11	PSO 1	PSO 2	PSO 3
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 (7-8)	Good (4-6)	Satisfactory (1-3)
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 (7-8)	Good (4-6)	Satisfactory (1-3)
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	Good analysis with minor shortcomings	Basic analysis provided
4.	Presentation & Communication	10	Well-organized report/presentation with clear communication	Organized presentation with minor errors	Average presentation and communication
	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					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 behavior 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's 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 a spectrophotometer.		
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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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: CO5

Sl. No	Criterion	Marks	Excellent	Good	Satisfactory
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,
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:CO6

Sl. No	Criterion	Marks	Excellent	Good	Satisfactory
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 strong 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: 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					
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					
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					
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 Hours				
Weightage:				
Continuous Assessment 50%				
End Semester Examinations 50%				
TEXT BOOK:				
1.	H.M. Deitel and P.J. Deitel, 'C: How to Program'. 9th edition, Pearson, New Delhi, 2022.			
2.	Herbert Schildt, 'C: The Complete Reference'. 4th edition, McGraw Hill, Noida, 2017.			
REFERENCE BOOKS:				
1.	Pradip Dey and Manas Ghosh, 'Programming in C'. Oxford University, New Delhi, 2018.			
2.	Mike McGrath, 'C Programming In Easy Steps Limited'. 5th edition, United Kingdom, 2018.			
3.	B.W. Kernighan and D.M. Ritchie, 'The C Programming Language'. 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

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PSO 1	PSO 2	PS O3
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)

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, 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" Mnuual 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	PSO1	PSO2	PSO3
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 (7-8)			Good(4-6)			Satisfactory (1-3)		
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:

	Evaluation of Student Work, Observation of Record and Model Test	Activity	Percentage allocation	Mapping Strength
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: Strength = 3 (if percentage >20%);

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

26MAC03	LINEAR ALGEBRA AND NUMERICAL METHODS B.E. CSE		SEMESTER		II		
Prerequisites		Category	BS	Credits		4	
26MAC01- Matrices and Calculus		Hours/ Semester	L	T	P	SL	TH
			45	15	-	60	120
COURSE OBJECTIVES							
1.	To understand the fundamental concepts of vector spaces, subspaces, linear dependence, linear independence, bases and dimensions in linear algebra.						
2.	To develop knowledge of linear transformations, matrix representations, eigen values, eigenvectors and diagonalization techniques with applications to systems of differential equations.						
3.	To acquire skills in inner product spaces, orthogonality, Gram–Schmidt orthogonalization and least square approximation methods.						
4.	To learn direct and iterative numerical methods for solving systems of linear equations, including decomposition and convergence techniques.						
5.	To understand and apply numerical methods for eigen value problems and generalized inverse techniques including power methods, QR decomposition and singular value decomposition methods.						
UNIT – I		VECTOR SPACES					9+3
Vector Spaces – Subspaces – Linear Combinations – Linear Span – Linear Dependence – Linear Independence – Bases and Dimensions.							
UNIT - II		LINEAR TRANSFORMATIONS					9+3
Linear Transformation – Null Space, Range Space – Dimension Theorem – Matrix representation of Linear Transformation – Eigen values and Eigenvectors of Linear Transformation – Diagonalization of Linear Transformation – Application of Diagonalization in Linear System of Differential Equations.							
UNIT - III		INNER PRODUCT SPACES					9+3
Inner Products and Norms – Inner Product Spaces – Orthogonal Vectors – Gram Schmidt Orthogonalization Process – Orthogonal Complement – Least Square Approximations.							
UNIT - IV		NUMERICAL SOLUTION OF LINEAR SYSTEM OF EQUATIONS					9+3
Solution of Linear System of Equations – Direct Methods: Gauss Elimination Method – Pivoting, Gauss Jordan Method, LU Decomposition Method and Cholesky Decomposition Method – Iterative Methods: Gauss– Jacobi Method, Gauss– Seidel Method and SOR Method.							
UNIT – V		NUMERICAL SOLUTION OF EIGENVALUE PROBLEMS AND GENERALISED INVERSES					9+3
Eigen Value Problems: Power Method – Inverse Power Method – Jacobi’s Rotation Method – QR Decomposition – Singular Value Decomposition Method.							
L:45, T:15, SL:60, Total:120 Hours							
Weightage:							
Continuous Assessment: 40%							
End Semester Examinations: 60%							

TEXT BOOKS:			
1.	Friedberg, S.H., Insel, A.J. and Spence, E., "Linear Algebra", Pearson Education, Fifth Edition, New Delhi, 2018.		
2.	Faires, J.D. and Burden, R., "Numerical Methods", Brooks/Cole (Thomson Publications), Fourth Edition, New Delhi, 2012.		
REFERENCE BOOKS:			
1.	Williams, G, "Linear Algebra with Applications", Jones & Bartlett Learning, First Indian Edition, New Delhi, 2019.		
2.	Kumaresan. S., "Linear Algebra – A geometric approach", Prentice Hall of India, Reprint, New Delhi, 2010.		
3.	Strang, G., "Linear Algebra and its applications", Cengage Learning, New Delhi, 2005.		
4.	Kandasamy.P, Thilagavathy.K, Gunavathi. K, "Numerical Methods", S. Chand & Co., New Delhi, 2005.		
E-RESOURCES:			
1.	NPTEL, "Linear Algebra" , National Programme on Technology Enhanced Learning, https://nptel.ac.in/courses/111101115		
2.	MIT OpenCourseWare, "Linear Algebra", Massachusetts Institute of Technology, https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/		
3.	Khan Academy, "Linear Algebra", https://www.khanacademy.org/math/linear-algebra		
4.	NPTEL – Numerical Methods and Programming https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ma45		
5.	MIT OpenCourseWare – Numerical Methods https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/		
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 vector spaces, linear transformations, inner product spaces, numerical solution techniques for linear systems and eigen value problems, including bases and dimensions, matrix representations, orthogonality, decomposition methods, iterative techniques and numerical methods for eigen value computations.	--	--
CO2	Apply the concepts and computational techniques of vector spaces, linear transformations, inner product spaces, numerical methods for linear systems and eigen value problems to solve mathematical and engineering problems involving matrix operations, orthogonalization, system of equations and eigen value computations.	PO1	PSO1, PSO2
CO3	Analyze mathematical and engineering problems using vector spaces, linear transformations, inner product spaces, numerical methods and eigen value techniques by selecting appropriate solution methods, examining convergence and accuracy, interpreting matrix decompositions, analyzing linear systems and eigen value behaviors.	PO2	PSO1, PSO2
CO4	Investigate and solve assignment-based and application-oriented problems involving vector spaces, orthogonality, numerical methods and matrix decompositions to enhance analytical thinking and mathematical modelling skills.	PO3	PSO2

C05	Develop computational and numerical solution strategies for linear systems and eigen value problems using decomposition methods, iterative techniques and matrix transformations in scientific and engineering applications.	PO5	PSO2
C06	Communicate mathematical and numerical solution procedures effectively through proper notation, algorithmic steps, computational results, error interpretation, graphical representation, structured report writing for linear algebra and numerical linear algebra problems.	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
C01														
C02	3											3	3	
C03		2										2	2	
C04			1										1	
C05					3								2	
C06										3				
Avg	3	2	1		3					3		2.5	2	

Activities:

1.	Students shall solve selected problems on linear systems, matrix decompositions, iterative methods and eigen value problems using Python, GeoGebra or open-source software. This activity develops computational and numerical problem-solving skills for scientific and engineering applications.
2.	Students shall prepare a structured report or presentation on selected applications of vector spaces, linear transformations, inner product spaces, matrix decompositions or eigen value problems. This activity develops the ability to communicate numerical procedures, computational results, error interpretation and conclusions effectively.

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Selection of numerical problem	8	Suitable problem is selected and clearly understood	Problem is relevant, but needs minor clarity	Problem selection is basic or unclear
2.	Application of numerical method	8	Correct method is applied with proper steps	Method is mostly correct with minor errors	Method is incomplete or incorrect
3.	Computational accuracy	8	Computations are accurate and well-presented	Minor computational errors are present	Major errors in computation

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 (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Clarity of explanation	8	Concepts and procedures are clearly explained	Explanation is understandable with minor gaps	Explanation is unclear
2.	Use of notation and representation	8	Proper notation, tables, 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
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	-	20	2
CO6	-	-	-	40	20	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%);

26ENC02	PROFESSIONAL ENGLISH B.E. (Common to all Branches)			SEMESTER			II	
Prerequisites			Category	HM	Credits			2
NIL			Hours/ Semester	L	T	P	SL	TH
				30	0	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, and 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 favorite 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%			
TEXT BOOKS:			
1.	Beare, Kenneth. <i>Reading Skills Success in 20 Minutes a Day</i> . 4th ed., LearningExpress, 2017.		
2.	Hewings, Martin. <i>Advanced English Grammar</i> . 3rd ed., Cambridge University Press, 2019.		
REFERENCE BOOKS:			
1.	Koneru, Aruna. <i>English Language Skills for Engineers</i> . McGraw Hill Education, 2020.		
2.	Murphy, Raymond. <i>English Grammar in Use</i> . 5th ed., Cambridge University Press, 2019.		
3.	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	PSO3
CO4	Analyze and interpret different forms of written texts such as stories, poems, newspaper articles, company profiles, advertisements, and technical documents.	PO9, PO11	PSO3
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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	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, and minutes of meetings, letters, resumes, cover letters, process descriptions, and advertisements. (i) Review Writing Activity: Write a critical review of a favourite 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 (7-8)	Good(4-6)	Satisfactory (1-3)
1.	Content Relevance and Completeness	8	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	8	Excellent adherence to format	Proper format with minor structural issues	Basic structure present but inconsistent formatting
3.	Clarity and Coherence	8	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	8	Excellent grammar, precise vocabulary, no errors	Minor grammatical/spelling errors	Noticeable errors but meaning is clear
5.	Audience Awareness and Purpose Fulfilment	8	Effectively addresses the intended audience using an appropriate tone and style	Generally, addresses the audience and purpose with minor lapses in tone	Limited awareness of audience and purpose; tone or content is not fully appropriate
	Total	40			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Presentation Skills	8	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	8	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	8	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	8	Excellent planning, coordination, and execution of tasks/events	Good organization with minor gaps in execution	Basic organization with limited efficiency

5.	Professionalism and Responsibility	8	Consistently demonstrates professionalism, punctuality, responsibility, and ethical conduct	Generally professional and responsible with minor lapses	Demonstrates basic responsibility but requires guidance to maintain professional standards
	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: Strength = 3 (if percentage >20%);

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

26CSC02	OBJECT ORIENTED PROGRAMMING USING C++		SEMESTER				II	
Prerequisites			Category	ES(PC)	Credits			3
26CSC01 - C Programming			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
COURSE OBJECTIVES								
1.	To understand the fundamentals of object-oriented programming concepts such as classes, objects, inheritance, polymorphism, abstraction, and encapsulation.							
2.	To develop problem-solving skills using the features of C++.							
3.	To design and implement programs using object-oriented techniques for real-world applications.							
4.	To understand advanced programming concepts such as templates, exception handling, and file handling.							
5.	To improve software development skills through modular, reusable, and maintainable code design.							
UNIT - I		INTRODUCTION TO C++ AND OOP CONCEPTS						9
Procedure-oriented programming paradigm - Object-oriented programming paradigm - Principles of object-oriented programming, benefits of OOP, application of OOP - C++ fundamentals –structure of C++ program, tokens, data types - Operators and expressions - Control structures – Functions and function overloading								
UNIT - II		CLASSES AND OBJECTS						9
Class definition and member functions- Access specifies, friend functions and friend classes - constructors and destructors - Static data members and static member functions -Arrays of objects - Operator overloading – binary and unary operator overloading using member function and friend function - Type conversions.								
UNIT - III		INHERITANCE AND POLYMORPHISM						9
Types of inheritance - Single, Multiple, Multilevel, Hierarchical, Hybrid, Visibility modes, Virtual base classes, constructors in derived classes - Pointers- pointers to objects, this pointer, pointers to derived classes, Function overriding, Virtual functions and Runtime polymorphism Abstract classes and Pure virtual functions								
UNIT - IV		TEMPLATES AND EXCEPTION HANDLING						9
Templates – function templates, function templates with multiple parameters, class template - class templates with multiple parameters - member function templates - Exception handling – basics exception handling mechanism, rethrowing an exception – Exception handling options – understanding terminate (), unexpected (), uncaught exception () and bad exception () functions								
UNIT - V		CONSOLE I/O AND FILE OPERATIONS						9
C++ Stream Classes – unformatted console I/O operations, formatted console I/O operations, manipulators - Files-classes for file operation, opening and closing a file, detecting end of file, file modes, sequential file operations, random file operations.								
L:45, SL:45, Total:90 Hours								

Weightage:

Continuous Assessment 40%

End Semester Examinations 60%

TEXT BOOK:

- | | |
|----|---|
| 1. | E. Balagurusamy, "Object–Oriented Programming with C++," Sixth Edition, Tata McGraw-Hill. |
|----|---|

REFERENCE BOOKS:

- | | |
|----|--|
| 1. | Bjarne Stroustrup, "The C++ Programming Language", Fourth Edition, Addison-Wesley. |
| 2. | Herbert Schildt, "The Complete Reference C++", Fifth Edition, Tata McGraw-Hill. |
| 3. | D. Ravichandran, "Programming with C++", Third Edition, Tata McGraw-Hill |
| 4. | Yashavant Kanetkar, "Let Us C", Seventeenth Edition, BPB |

E-RESOURCES:

- | | |
|----|---|
| 1. | https://nptel.ac.in/courses/106105234 |
| 2. | https://en.cppreference.com |
| 3. | https://www.youtube.com/watch?v=vLnPwxZdW4Y |
| 4. | https://www.youtube.com/@CodeWithHarry |
| 5. | https://www.hackerrank.com/domains/cpp |

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

CO1	Familiarize the object-oriented programming concepts	--	PSO1
CO2	Apply object-oriented programming concepts for developing applications.	PO1	PSO1
CO3	Analyze the C++ program for the given scenario	PO2	PSO1
CO4	Design and develop a solution for a simple problem	PO3	PSO1
CO5	As an individual, to design C++ programs for a given requirement and present the solution through a presentation	PO3, PO7, PO9	PSO1
CO6	As a member of a team , designing a simple application to provide a solution to a real-world problem through a presentation or hackathon .	PO3, PO6, PO7, PO8, PO9, P10	PSO1

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												2		
CO2	3											2		
CO3		2										2		
CO4			1									2		
CO5			2				2		2			2		
CO6			2			2	2	2	2	2	2	2		

Activities:

1.	Article Reviews, Quiz, Assignment, Flipped Class practice, Seminar Presentation, Peer Assessment (CO5)
2.	Project-Based Learning, Case Study Analysis, Simulation Activities (CO6) (Team)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Define the Problem & Test cases	10	Problem and test cases are clearly defined	Problem defined, but some of the test cases are Unclear	Problem statement defined, but unclear test cases
2.	Design and implementation	10	Design and implementation are done efficiently	Design and implementation are done	Design and implementation are incomplete
3.	Interpretation of results	10	Results are clearly interpreted & justified	Results are interpreted, but limited justification	Unclear interpretation
4.	Presentation & Communication	10	The presentation is clear and well-structured	The presentation is structured, but needs improvement	Poorly structured report
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Identification	5	Clearly identifies a relevant real-world problem with strong justification	Problem identified with adequate explanation	Problem identified, but lacks clarity
2.	Innovation & Creativity	10	Highly innovative and unique solution	Moderately creative solution	Limited innovation

3.	Application Design and Implementation	10	User-friendly, effective design and functions effectively with proper coding standards	Good design and mostly functional	Basic design with limited usability and partially functional
4.	Team Collaboration	5	Excellent coordination and equal participation among members	Good teamwork with minor imbalance	Limited collaboration
5.	Presentation Skills	10	Clear and confident, presentation	Good presentation with minor communication issues	Average presentation
	Total	40			

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: 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								
1.	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, 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 Subramaniyam. 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

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			

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 not able 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.	Viva voice	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			

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														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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	Good	Satisfactory
1.	Accuracy of Engineering Curves	20	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	25	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	20	Developments are accurate with correct geometry and layout	Minor dimensional or layout errors	Significant errors in development
4.	Use of Drawing Instruments and Standards	15	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	20	Excellent line quality, lettering, dimensioning, and sheet layout	Acceptable presentation with few inconsistencies	Poor presentation and organization
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Accuracy of Orthographic Views	25	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	20	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	20	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	20	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	15	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	100			

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

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
C01	10	10			10	2
C02	10				5	1
C03	40	20			30	2
C04		30			15	2
C05			40		20	3
C06				40	20	3
Total	60	60	40	40	100	

Note: 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		Category	HM	Credits			1
தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படைகள்		Hours/ Semester	L	T	P	SL	TH
			15	0	0	15	30
பாட நோக்கங்கள்							
1.	நெசவுத் தொழில்நுட்பம் மற்றும் மட்பாண்டத் தொழில்நுட்பம் குறித்த அறிவைப் பெறுதல்.						
2.	சங்ககாலம் மற்றும் ஆங்கிலேயர் ஆட்சிக் கால கட்டிட வடிவமைப்பு மற்றும் கட்டுமானத் தொழில்நுட்பங்களை அறிதல்.						
3.	உற்பத்தித் தொழில்நுட்பங்களைப் பற்றிய புரிதலை வளர்த்தல்.						
4.	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்ப அறிவைப் பெறுதல்.						
5.	அறிவியல் தமிழ் மற்றும் தமிழ் கணினியியல் வளர்ச்சியை அறிதல்.						
அலகு - I		நெசவு மற்றும் பாணை தொழில்நுட்பம்					3
சங்க காலத்தில் நெசவுத் தொழில் - பாணை தொழில் நுட்பம் - கருப்பு சிவப்பு பாண் டங்கள் - பாண் டங்களில் கீறல் குறியீடுகள்.							
அலகு - II		வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்					3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும் , கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபொட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்நோ சாரோசெனிக் கட்டிடக் கலை.							
அலகு - III		உற்பத்தித் தொழில் நுட்பம்					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 - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.							
அலகு - IV		வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்					3
வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் அணைகள், ஏரிகள், குளங்கள் மற்றும் மதகு அமைப்புகள், சோழர் கால குமிழித் தூம்பின் முக்கியத்துவம், கால்நடை வளர்ப்பு மற்றும் கால்நடைகளுக்கான கிணறு வடிவமைப்புகள், வேளாண்மை மற்றும் வேளாண் செயலாக்கம், கடல் மற்றும் பெருங்கடல் அறிவு, மீன்பிடித்தல், முத்துக்குளித்தல் மற்றும் சங்கு மூழ்குதல், அறிவு சார்ந்த சமூக அமைப்பு, அறிவியல் தமிழின் வளர்ச்சி, தமிழ் கணினியியல், தமிழ் நூல்களின் மின்னாக்கம், தமிழ் மென்பொருள் வளர்ச்சி, தமிழ் இணையக் கல்விக்கழகம், தமிழ் மின்னணு நூலகம், இணையத் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்.							

அலகு - V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ்	3	
அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி- தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென் பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.			
L:15, SL:15, Total:30 Hours			
மதிப்பீட்டு விகிதம்: தொடர் மதிப்பீடு: 40% பருவ இறுதித் தேர்வுகள்: 60%			
குறிப்பு நூல்கள்:			
1.	"தமிழர் வரலாறு" – பி.டி .சீனிவாச ஐயங்கார்		
2.	"சங்க இலக்கியமும் பண்பாடும்" – மு .வரதராசனார்		
3.	"பண்டைய இந்தியா :தமிழ்நாட்டின் வரலாறும் பண்பாடும்" – இரா .நாகசாமி		
4.	"தமிழ் கணினியியல் மற்றும் மின்னணு வளங்கள்" – தமிழ் இணையக் கல்விக்கழக வெளியீடுகள்		
மின்னணு வளங்கள்:			
1.	https://www.tamilvu.org/		
2.	https://www.tnau.ac.in/		
3.	https://icar.org.in/		
4.	https://www.tamilvu.org/		
5.	https://ndl.iitkgp.ac.in/		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			
CO1	நெசவு மற்றும் மட்பாண்டத் தொழில்நுட்பம் பற்றிய அறிவைப் பெறுவர்.	PO9	-
CO2	சங்ககாலம் மற்றும் ஆங்கிலேயர் கால கட்டிட வடிவமைப்பு மற்றும் கட்டுமானத் தொழில்நுட்பங்களை அறிந்திருப்பர்.	PO1, PO9	-
CO3	உற்பத்தித் தொழில்நுட்பங்களைப் புரிந்துகொள்வர்.	PO9	PSO1
CO4	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பத் திறன்களைப் பெறுவர்.	PO2, PO9	
CO5	அறிவியல் தமிழ் மற்றும் தமிழ் கணினியியல் வளர்ச்சி குறித்த அறிவைப் பெறுவர்.	PO9, PO10	PSO3
CO6	களப்பணி மற்றும் மின்னணு கற்றல் நடவடிக்கைகள் மூலம் தமிழ் பாரம்பரியத்தைப் புரிந்துகொள்வர்.	PO8, PO9, PO10	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 1	PSO 2	PSO 3
C01									3					
C02									3					
C03									3			2		
C04									3					
C05									3		2			2
C06									3		2			2

Activities:

1.	செயல்பாடுகள் (C05) - அறிவியல் தமிழின் வளர்ச்சி வரலாற்றை விளக்கும் அறிக்கை தயாரித்தல். - தமிழ் மென்பொருட்கள், எழுத்துருக்கள் மற்றும் மின்னணு தளங்கள் குறித்த PowerPoint வழங்கல் தயாரித்தல். - இணையத் தமிழ் அகராதி, தமிழ் இணையக் கல்விக்கழகம் 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.	செயல்பாடுகள் (C06) - பாரம்பரியத் தளங்கள் / அருங்காட்சியகங்கள் / கோயில்களுக்கு களப்பயணம் செய்து புகைப்படங்களுடன் அறிக்கை சமர்ப்பித்தல். - உள்ளூர் கலாச்சாரப் பாரம்பரியம் 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 ஸ்கிராப் புத்தகம்) Digital Scrapbook) அல்லது e-Portfolio உருவாக்குதல். - பண்டைய தமிழ் தொழில்நுட்பம் அல்லது அறிவு அமைப்புகளில் ஏதேனும் ஒன்றை அடிப்படையாகக் கொண்ட வழக்குக்கூற்று) Case Study) வழங்குதல்.

Rubrics for evaluation (மதிப்பீட்டு அளவுகோல்கள்): C05

வரி சை எண்	அளவுகோல்	மதிப்பெண்கள்	சிறப்பு (9–10)	நல்லது (6–8)	திருப்திகரமானது (1–5)
1.	தமிழ் பாரம்பரிய அறிவு	10	தமிழ் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டு பாரம்பரியத்தை முழுமையாகவும் துல்லியமாகவும் விளக்குகிறது.	நல்ல புரிதலை வெளிப்படுத்துகிறது; சில சிறிய விடுபாடுகள் இருக்கலாம்.	அடிப்படை அறிவை மட்டுமே காட்டுகிறது; விவரங்கள் குறைவாக உள்ளன.
2.	வரலாற்றுப் புரிதல்	10	வரலாற்றுப் பின்னணி மற்றும் அதன் முக்கியத்துவத்தை பொருத்தமான எடுத்துக்காட்டுகளுடன் தெளிவாக விளக்குகிறது.	வரலாற்றுப் பின்னணியை சில எடுத்துக்காட்டுகளுடன் விளக்குகிறது.	வரலாற்றுப் பின்னணி குறித்த விளக்கம் மிகவும் வரையறுக்கப்பட்டுள்ளது.

3.	தற்காலப் பொருத்தம்	10	பாரம்பரிய அறிவையும் சாதனைகளையும் தற்போதைய பயன்பாடுகளுடன் திறம்பட இணைக்கிறது.	பாரம்பரிய அறிவை நவீன பயன்பாடுகளுடன் ஓரளவு தெளிவாக தொடர்புபடுத்துகிறது.	சில நவீன தொடர்புகளை மட்டுமே அடையாளம் காட்டுகிறது.
4.	வழங்கல் திறன்	10	உள்ளடக்கம் சிறப்பாக ஒழுங்குபடுத்தப்பட்டு, காட்சிப்பூர்வமாக கவர்ச்சிகரமாகவும் பயனுள்ளதாகவும் வழங்கப்படுகிறது.	உள்ளடக்கம் நன்கு ஒழுங்குபடுத்தப்பட்டு, சில குறைகளுடன் வழங்கப்படுகிறது.	வழங்கல் அடிப்படை நிலையில் உள்ளது; தெளிவு மற்றும் ஒழுங்கமைப்பு குறைவாக உள்ளது.
5.	தொடர்புத் திறன்	10	கருத்துக்கள் தெளிவாகவும் நம்பிக்கையுடனும் ஆதாரங்களுடன் விளக்கப்படுகின்றன.	கருத்துக்கள் போதுமான ஆதாரங்களுடன் தெளிவாக வெளிப்படுத்தப்படுகின்றன.	கருத்துக்கள் புரியும் வகையில் இருந்தாலும் தெளிவு, நம்பிக்கை அல்லது ஆதாரங்கள் குறைவாக உள்ளன.
	மொத்தம்	50			

Rubrics for evaluation (மதிப்பீட்டு அளவுகோல்கள்): C06

வரிசை எண்	அளவுகோல்	மதிப்பெண்கள்	சிறப்பு (9–10)	நல்லது (6–8)	திருப்திகரமானது (1–5)
1.	அறிவின் பயன்பாடு	10	தமிழ் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டு கருத்துக்களை செயல்முறைப் பணிகளில் திறம்படப் பயன்படுத்துகிறது.	கருத்துக்களை சரியாகப் பயன்படுத்துகிறது; குறைந்த வழிகாட்டுதல் தேவைப்படுகிறது.	அடிப்படை அளவில் மட்டுமே கருத்துக்களைப் பயன்படுத்துகிறது.
2.	திட்ட செயல்படுத்தல்	10	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	10	பொருத்தமான தரவுகள், ஆதாரங்கள் மற்றும் எடுத்துக்காட்டுகளை திறம்படப் பயன்படுத்துகிறது.	பொருத்தமான வளங்களைப் பயன்படுத்தி போதுமான ஆதாரங்களை வழங்குகிறது.	குறைந்த அளவிலான வளங்கள் மற்றும் ஆதாரங்களை மட்டுமே பயன்படுத்துகிறது.
4.	வழங்கல் திறன்	10	கண்டறிவுகளை தெளிவாகவும் தொழில்முறையாகவும் திறம்படவும் வழங்குகிறது.	கண்டறிவுகள் தெளிவாக வழங்கப்படுகின்றன; சில சிறிய குறைகள் உள்ளன.	வழங்கல் போதுமானதாக இருந்தாலும் தெளிவு, ஒழுங்கமைப்பு அல்லது தொழில்முறைத் தன்மை குறைவாக உள்ளது.

5.	ஆவணப்படுத்தல் தரம்	10	ஆவணங்கள் முழுமையாகவும் துல்லியமாகவும் ஒழுங்குபடுத்தப்பட்டு ம் சரியான வடிவமைப்புடனும் உள்ளன.	ஆவணங்கள் முழுமையாகவும் ஒழுங்காகவும் உள்ளன; சில சிறிய விடுபாடுகள் இருக்கலாம்.	ஆவணங்கள் போதுமானதாக இருந்தாலும் விவரம், துல்லியம் அல்லது ஒழுங்கமைப்பு குறைவாக உள்ளது.
	மொத்தம்	50			

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	-	-	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
2.	Sangam Literature and Culture”– M. Varadarajan
3.	“Ancient India: History and Culture of Tamil Nadu”– R. Nagaswamy
4.	“Tamil Computing and Digital Resources”– Tamil Virtual Academy Publications

E-RESOURCES:

1.	https://www.tamilvu.org/
2.	https://www.tnau.ac.in/
3.	https://icar.org.in/
4.	https://www.tamilvu.org/
5.	https://ndl.iitkgp.ac.in/

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.	PO1, PO9	-
CO3	Understanding about the manufacturing technologies.	PO9	PSO1
CO4	Acquire the skills in agriculture and irrigation technology.	PO2, PO9	-
CO5	Acquire the knowledge about the development of Scientific Tamil and Tamil computing.	PO9, PO10	PSO3
CO6	Develop an understanding of Tamil heritage through field-based and digital learning activities.	PO8, PO9, PO10	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					
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. 6. 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	10	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	10	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	10	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	10	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	10	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	50			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (7-8)	Good(4-6)	Satisfactory (1-3)
1.	Application of Knowledge	10	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	10	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	10	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	10	Presents findings clearly, professionally, and effectively.	Presents findings clearly with minor shortcomings.	Presentation is adequate but lacks clarity, organization, or professionalism.
5.	Documentation Quality	10	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	50			

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: 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	
NIL				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 behavior and practical applications of dielectric materials in electrical and electronic systems.								
3.	To analyses 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), Nano sensors 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	Analyze 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	Analyze 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	Good	Satisfactory
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	Good	Satisfactory
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	Good	Satisfactory
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%);

26CSC03	OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY		SEMESTER				II	
Prerequisites			Category	ES(PC)		Credits		2
26CSC01 - C Programming			Hours/ Semester	L	T	P	SL	TH
				0	0	45	15	60
COURSE OBJECTIVES								
1.	To understand the fundamentals of object-oriented programming concepts such as classes, objects, inheritance, polymorphism, abstraction, and encapsulation.							
2.	To develop problem-solving skills using C++ features.							
3.	To design and implement object-oriented programs for real-world applications.							
4.	To develop a program using advanced programming concepts such as templates, exception handling, and file operations.							
5.	To improve software development skills through modular, reusable, and maintainable code design.							
EXPERIMENTS								
1.	Programs using control structures.							
2.	Programs Using Functions • Implementation of Functions with default arguments • Implementation of parameter passing by Value, and Reference • Implementation of Function Overloading							
3.	Programs using Class • Class with primitive data members • Class with static member • Class with friend function							
4.	To implement compile-time polymorphism • Constructors and Destructors • Operator Overloading - Unary and Binary Operators. • Type conversions							
5.	To implement Inheritances • Single inheritance • Multiple inheritance • Hierarchical inheritance • Virtual Base Classes							
6.	To implement Runtime Polymorphism							
7.	To implement Templates • Function templates • Class templates							
8.	To implement the Exception Handling Mechanism • Handling pre-defined type • Handling user-defined type							
9.	Console I/O • Formatted functions • Create your own manipulator							
10.	File Operations • Sequential Access • Random Access							
T:45, SL:15, Total:60 Hours								

Weightage: Continuous Assessment 60% End Semester Examinations 40%				
TEXT BOOK:				
1.	E. Balagurusamy, "Object–Oriented Programming with C++," Sixth Edition, Tata McGraw-Hill.			
REFERENCE BOOKS:				
1.	Bjarne Stroustrup, "The C++ Programming Language", Fourth Edition, Addison-Wesley.			
2.	Herbert Schildt, "The Complete Reference C++", Fifth Edition, Tata McGraw Hill.			
3.	D. Ravichandran, "Programming with C++", Third Edition, Tata McGraw-Hill			
4.	Yashavant Kanetkar, "Let Us C", Seventeenth Edition, BPB			
E-RESOURCES:				
1.	https://nptel.ac.in/courses/106105234			
2.	https://en.cppreference.com			
3.	https://www.youtube.com/watch?v=vLnPwxZdW4Y			
4.	https://www.youtube.com/@CodeWithHarry			
5.	https://www.hackerrank.com/domains/cpp			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Familiarize the object-oriented programming concepts		--	PSO1
CO2	Apply object-oriented programming concepts for developing applications.		PO1	PSO1
CO3	Investigate and conduct practical experiments to implement the object-oriented concepts using C++.		PO2, PO4	PSO1
CO4	Design and develop reusable libraries/utilities like date, time, string, or components in C++		PO5	PSO1
CO5	As an individual, to design C++ programs for a given requirement and present the solution through a presentation		PO3, PO7, PO9	PSO1
CO6	Collaborate effectively in teams to design, develop, and present a simple C++ application that provides a solution to a real-world problem through presentations or hackathons.		PO3, PO6, PO7, PO8, PO9, P10	PSO1

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												2		
CO2	3											2		
CO3		3		3								2		
CO4					1							2		
CO5			2				2		2			2		
CO6			2			2	2	2	2	2	2	2		

Activities:

1.	Simple tools design reusable libraries/utilities like date, time, string, or a generic stack, queue, or list (CO4)
2.	Article Reviews, Quiz, Assignment, Flipped Class practice, Seminar Presentation, Peer Assessment (CO5)
3.	Project-Based Learning, Case Study Analysis, Simulation Activities (CO6) (Team)

Rubrics for evaluation: CO4

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Design and implementation	5	Design and implementation are done efficiently	Design and implementation are done	Design and implementation are incomplete (1)
2.	Presentation & Communication	5	presentation is clear and well-structured	The presentation is structured, but needs improvement	Poorly structured report (1)
	Total	10			

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Define the Problem & Test cases	5	Problem and test cases are clearly defined	Problem defined, but some of the test cases are Unclear	Problem statement defined, but unclear test cases
2.	Design and implementation	5	Design and implementation are done efficiently	Design and implementation are done	Design and implementation are incomplete
3.	Interpretation of results	5	Results are clearly interpreted & justified	Results are interpreted, but limited justification	Unclear interpretation
4.	Presentation & Communication	5	Presentation is clear and well-structured	The presentation is structured, but needs improvement	Poorly structured report
	Total	20			

Rubrics for evaluation: C06					
Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Identification	3	Clearly identifies a relevant real-world problem with strong justification	Problem identified with adequate explanation	Problem identified, but lacks clarity (1)
2.	Innovation & Creativity	4	Highly innovative and unique solution	Moderately creative solution	Limited innovation
3.	Application Design and Implementation	5	User-friendly, effective design and functions effectively with proper coding standards	Good design and mostly functional	Basic design with limited usability and partially functional
4.	Team Collaboration	3	Excellent coordination and equal participation among members	Good teamwork with minor imbalance	Limited collaboration
5.	Presentation Skills	5	Clear and confident, presentation	Good presentation with minor communication issues	Average presentation
	Total	20			
The Internal Assessment Matrix (IAM) for the defined COs:					
CO	Evaluation of Student Work, Observation of Record and Model Test	Activities	Percentage allocation	Mapping Strength	
C01	10	10	10	1	
C02	20	20	20	3	
C03	20	20	20	3	
C04	20	10	15	2	
C05	20	20	20	3	
C06	10	20	15	2	
Total	100	100	100		
Note: 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			

26MA301	PROBABILITY AND STATISTICS B.E. (CSE)				SEMESTER			III	
Prerequisites				Category	BS	Credits		3	
NIL				Hours/ Semester	L	T	P	SL	TH
					45	15	0	30	90
COURSE OBJECTIVES									
1.	To understand the fundamental concepts of probability distributions, random variables, moments and moment generating functions used in statistical analysis.								
2.	To develop knowledge of joint distributions, correlation, regression and transformation techniques for multivariable statistical analysis.								
3.	To acquire skills in estimation theory, sampling distributions and parameter estimation methods for statistical inference.								
4.	To learn hypothesis testing procedures, significance tests and chi-square tests for analyzing statistical data and decision-making.								
5.	To understand the principles and applications of experimental design techniques such as completely randomized design randomized block design, Latin square design and factorial design.								
UNIT - I		ONE– DIMENSIONAL RANDOM VARIABLES							9+3
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a random variable.									
UNIT - II		TWO– DIMENSIONAL RANDOM VARIABLES							9+3
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).									
UNIT - III		ESTIMATION THEORY							9+3
Sampling distributions – Characteristics of good estimators – Method of Moments – Maximum Likelihood Estimation – Interval estimates for mean, variance and proportions.									
UNIT - IV		TESTS OF SIGNIFICANCE							9+3
Type me and Type II errors – Tests for single mean, proportion, Difference of means (large and small samples) - Tests for single variance and equality of variances – χ^2 test for goodness of fit – Independence of attributes.									
UNIT - V		DESIGN OF EXPERIMENTS							9+3
Completely Randomized Design – Randomized Block Design – Latin Square Design – 2X2 factorial designs.									
L:45, T:15, SL:30, Total:90 Hours									
Weightage: Continuous Assessment: 40% End Semester Examinations: 60%									
TEXT BOOKS:									
1.	Irwin Miller and Marylees Miller, John E. Freund's, "Mathematical Statistics with applications", Pearson India Education, Asia, 8th Edition, 2014.								
2.	Walpole, R.E., Myers R.H., Myres S.L., and Ye K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2024.								

REFERENCE BOOKS:

1.	Richard A. Johnson, Irwin Miller, John Freund "Miller & Freund's Probability and Statistics for Engineers", Person Education, 8th Edition, 2015.
2.	Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 5th Edition, 2014.
3.	Spiegel, M.R., Schiller, J. Srinivasan, R.A. and Goswami, D. "Schaum's Outline of Theory and Problems for Probability and Statistics", McGraw Hill Education, 3rd Edition, Reprint, 2017.

E-RESOURCES:

1.	NPTEL, "Probability and Statistics", National Programme on Technology Enhanced Learning, https://nptel.ac.in/courses/111105041
2.	NPTEL, "Design and Analysis of Experiments", National Programme on Technology Enhanced Learning, https://nptel.ac.in/courses/110105087
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, random variables, estimation theory, tests of significance and design of experiments, including statistical distributions, sampling theory, parameter estimation, hypothesis testing and experimental design techniques.	--	--
CO2	Apply probability distributions, estimation methods, hypothesis testing techniques, and experimental design principles to analyse statistical data and solve real-world problems in science, engineering and research applications.	PO1	PSO1
CO3	Analyze statistical and experimental data using probability distributions, estimation techniques, hypothesis testing, correlation and regression analysis and design of experiments by selecting appropriate statistical methods and interpreting results effectively.	PO2	PSO2
CO4	Develop statistical models and apply estimation and testing procedures for solving engineering and research-oriented problems involving uncertainty and data analysis.	PO3	PSO1, PSO2
CO5	Utilize statistical software tools and quantitative techniques for analysing experimental data, interpreting results and supporting decision-making processes.	PO5	--
CO6	Investigate assignment-based and real-world statistical problems through experimental design and inferential analysis to enhance critical thinking and analytical skills.	P10	--

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														
CO2	3											3		
CO3		2											2	
CO4			1									1	1	
CO5					3									
CO6										3				
Avg	3	2	1		3					3		2	1.5	

Activities:

1.	Students shall analyze selected experimental or real-world datasets using statistical software tools such as Excel, R, Python, SPSS, or any open-source software. The activity may include probability distribution fitting, estimation of parameters, hypothesis testing, correlation, regression, ANOVA and interpretation of statistical results for decision-making.
2.	Students shall investigate selected real-world or assignment-based statistical problems involving probability distributions, sampling, estimation, tests of significance, regression analysis, or design of experiments. Students shall prepare a short report with problem statement, method, calculations, interpretation, conclusion and practical significance.

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 software/tool	8	Software/tool is used effectively with correct procedure	Tool is used properly with minor errors	Tool usage is limited or unclear
3.	Accuracy of statistical analysis	8	Analysis is accurate with correct statistical methods	Analysis is mostly correct with minor errors	Analysis contains major errors
4.	Interpretation of results	8	Results are clearly interpreted for 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.	Identification of statistical problem	8	Problem is clearly identified with proper objective	Problem is identified, but needs minor improvement	Problem statement is unclear
2.	Application of statistical method	8	Appropriate method is applied correctly with proper steps	Method is mostly correct with minor errors	Method is incomplete or incorrect
3.	Analysis and interpretation	8	Results are analysed and interpreted clearly with practical relevance	Interpretation is acceptable, but limited	Analysis and interpretation are weak
4.	Report writing and conclusion	8	Report is well-structured with clear conclusion	Report is organized, but needs improvement	Report is incomplete or poorly structured
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	-	20	2
CO6	-	-	-	40	20	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%);

26CSC04	COMPUTER ARCHITECTURE			SEMESTER			III	
Prerequisites			Category	ES(PC)	Credits		3	
NIL			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
COURSE OBJECTIVES								
1.	Understand digital logic, data representation and computer organization fundamentals.							
2.	Analyze register transfer operations, instruction execution and CPU organization.							
3.	Apply architectural concepts in memory and I/O subsystem design.							
4.	Investigate processor performance using pipelining and parallel processing concepts.							
5.	Develop self-learning and tool-based analysis skills in computer architecture.							
UNIT - I		DIGITAL LOGIC AND DATA REPRESENTATION						9
Logic gates, Boolean algebra, combinational circuits, flip-flops, sequential circuits, number systems, complements, fixed and floating-point representation, error detection codes.								
UNIT - II		REGISTER TRANSFER AND BASIC COMPUTER ORGANIZATION						9
Register transfer language, bus and memory transfers, arithmetic, logic and shift microoperations, instruction codes, computer registers, instruction cycle, memory reference instructions, interrupts.								
UNIT - III		COMPUTER ARITHMETIC, PIPELINING AND VECTOR PROCESSING						9
Addition, subtraction, multiplication and division algorithms, floating-point arithmetic. Parallel processing, instruction and arithmetic pipelines, vector processing,								
UNIT - IV		CPU ORGANIZATION AND MICRO PROGRAMMED CONTROL						9
Control memory, address sequencing, microprogramming, register organization, stack organization, instruction formats, addressing modes, RISC and CISC concepts.								
UNIT - V		MEMORY AND I/O ORGANIZATION						9
I/O interfaces, DMA, interrupt handling, memory hierarchy, cache memory, virtual memory, associative memory, memory management and multiprocessor overview.								
L:45, SL:45, Total: 90 Hours								
Weightage: Continuous Assessment 40% End Semester Examinations 60%								
TEXT BOOK:								
1.	M. Morris Mano, Computer System Architecture, 3rd Edition, Pearson.							

REFERENCE BOOKS:

- | | |
|----|--|
| 1. | Carl Hamacher et al., Computer Organization and Embedded Systems, McGraw Hill. |
| 2. | William Stallings, Computer Organization and Architecture. |
| 3. | David A. Patterson and John L. Hennessy, Computer Organization and Design. |
| 4. | John P. Hayes, Computer Architecture and Organization |
| 5. | V. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization. |
| 6. | Andrew S. Tanenbaum, Structured Computer Organization. |

E-RESOURCES:

- | | |
|----|--|
| 1. | NPTEL – Computer Organization and Architecture |
| 2. | MIT Open Course Ware – Computer Systems |
| 3. | Gate Smashers COA Playlist |
| 4. | Intel Architecture Manuals |

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

CO1	Explain the fundamental concepts of digital logic, data representation and computer architecture.	–	PSO1
CO2	Apply computer organization principles to perform instruction execution and architectural computations.	PO1	PSO1
CO3	Analyze CPU organization, control unit design, memory hierarchy and I/O mechanisms.	PO2, PO3	PSO1
CO4	Investigate processor performance using simulation/tools and interpret architectural results.	PO4, PO5	PSO1
CO5	Study recent advances in processor, memory and parallel architectures through self-learning and present findings considering societal and economic impact.	PO6, PO8, PO9, PO10, PO11	PSO1
CO6	Evaluate contemporary processor architectures and memory technologies through self-directed study of research articles, technical reports and industry case studies, and present the outcomes effectively while addressing sustainability, project management and lifelong learning aspects.	PO6, PO9, PO10, PO11	PSO1

The Course Articulation Matrix (CAM) for defined Cos:

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

3 / 2 / 1 – indicates strength of correlation (3 – High, 2 – Medium, 1 – Low)

Activities:

1.	Simulation-Based Analysis of Computer Architecture Components
2.	Seminar / Case Study / Technical Report on Emerging Trends in Computer Architecture

Rubrics For Evaluation – CO5 (Seminar / Hackathon / Technical Presentation)

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Formulation Architecture Selection	20	Problem clearly defined with appropriate architectural model	Problem defined with minor omissions	Problem definition incomplete
2.	Simulation / Tool Implementation	30	Correct implementation with complete simulation results	Minor implementation errors	Incomplete implementation
3.	Analysis & Interpretation of Results	30	Results accurately analyzed and justified	Analysis adequate with limited justification	Analysis lacks clarity
4.	Report Preparation & Presentation	20	Well-structured report and effective presentation	Report acceptable with minor issues	Poorly organized report
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Technical Understanding of Emerging Architecture	25	Demonstrates thorough understanding with current developments	Adequate understanding of concepts	Limited understanding
2.	Evidence of Self-Learning & Literature Survey	25	Uses recent journals, conference papers and industry reports	Uses relevant sources with limited depth	Uses very few sources
3.	Societal, Economic & Sustainability Considerations	25	Clearly discusses impact on society, economy and sustainability	Discusses impacts with limited analysis	Minimal discussion of impacts
4.	Communication & Presentation Skills	25	Professional presentation with clear communication	Presentation satisfactory	Presentation lacks 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	16	16	-	-	16	2
C04	8	8	-	-	8	1
C05	-	-	40	-	20	2
C06	-	-	-	40	20	2
Total	60	60	40	40	100	

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

26CSC05	JAVA PROGRAMMING		SEMESTER				III
Prerequisites		Category	ES(PC)	Credits			3
26CS302 - Object oriented programming C++		Hours/ Semester	L	T	P	SL	TH
			45	0	0	45	90
COURSE OBJECTIVES							
1.	To understand the fundamentals of object-oriented programming concepts and the Java programming environment, including JVM architecture, JRE, and JDK.						
2.	To develop Java programs using classes, objects, constructors, methods, inheritance, interfaces, and packages for implementing object-oriented solutions.						
3.	To apply exception handling and multithreading concepts in Java programs to build reliable and concurrent applications.						
4.	To use Java collections, generics, file handling, I/O streams, and modern programming features such as lambda expressions and streams API for efficient application development.						
5.	To design and develop Java-based desktop and basic web applications using event handling, GUI components, Servlets, and Apache Tomcat and JDBC Connectivity for real-world problem solving.						
UNIT - I	INTRODUCTION to JAVA						9
Fundamentals of object oriented programming – Features of Object-Oriented Programming – Evolution of Java - Overview of Java – JVM Architecture – JRE vs JDK– Data Types, Variables, Operators, Expressions – Control flow Statements – Methods – Arrays – Classes and Objects – Constructors – Access Specifiers – Static Members – this keyword – constants – String Class.							
UNIT - II	INHERITANCE AND PACKAGES						9
Methods – Static, Nested and Inner Classes – Inheritance – Superclasses and Subclasses – Method Overriding – Downcasting – instance of Operator – Abstract and Final Classes – Interfaces – Packages – Package Member Access – Importing Packages.							
UNIT - III	EXCEPTION HANDLING AND MULTITHREADING						9
Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java Built-in Exceptions – User-defined Exceptions – Multithreaded Programming: Java Thread Model – Creating Threads – Runnable Interface – Multiple Threads – Thread Lifecycle – Thread Priorities – Synchronization – Inter-thread Communication – Avoiding Deadlocks.							
UNIT - IV	COLLECTIONS, FILE STREAMS AND GENERICS						9
Java I/O Streams – Reading and Writing Files – Object Serialization – Wrapper Classes – Autoboxing and Unboxing – Generic Classes – Generic Methods – Collection Framework – List, Set, Map – Lambda Expressions – Streams API.							
UNIT - V	EVENT HANDLING AND WEB DEVELOPMENT						9
Event handling: Events, Listeners, Adapter Classes, Anonymous Inner Classes – AWT Basics – Swing Components – Layout Managers – Java Servlets – Apache Tomcat – Introduction to Java Web Applications- DataBase Connection with Java.							
L:45, P:0, SL:45, Total:90 Hours							

Weightage:

Continuous Assessment 40%

End Semester Examinations 60%

TEXT BOOK:

1. Patric Naughton, Herbert Schildt, "The Complete Reference Java2", Twelfth edition, Tata McGraw Hill, 2021.

2. E. Balaguruswamy, "Programming with Java", Sixth Edition, Tata McGraw Hills, 2019.

REFERENCE BOOKS:

1. Cay S. Horstmann, Gary Cornell, "Core Java2", Twelfth Edition, Pearson Education, 2021.

2. Graham Hamilton, Rick Cattell, Maydene Fisher, "JDBC Database access with Java".

3. Paul Deitel and Harvey Deitel, "Java How to Program", Tenth Edition, Pearson Prentice Hall.

4. E. Brown, "Web Development with Node and Express: Leveraging the JavaScript Stack", 2nd edition, O'Reilly Media, 2019.

E-RESOURCES:

1. <https://nptel.ac.in/courses/106105191>

2. <https://www.w3schools.com/java/>

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 and core concepts of Java Programming	--	PSO1
CO2	Apply programming skills to develop JAVA programs for solving real world problems	PO1	PSO1
CO3	Analyze the given JAVA program for the given scenario.	PO2, PO3	PSO1
CO4	Design and develop a solution for a given scenario.	PO5	PSO1
CO5	Assess and justify suitable solutions for real-world problems using Java programming concepts through presentation as an individual.	PO8, PO9, PO10	PSO1
CO6	Collaborate in teams to investigate concepts, designing a simple application to provide a solution to a real-world problem through a presentation or hackathon.	PO5, PO8, PO9, PO10, PO11	PSO1

The Course Articulation Matrix (CAM) for defined COs

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

Activities:

1.	Article Reviews, Quiz, Assignment, Flipped Class practice, Seminar Presentation, Peer Assessment (CO5)				
2.	Project-Based Learning, Case Study Analysis, Simulation Activities (CO6) (Team)				

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Define the Problem & Test cases	10	Problem and test cases are clearly defined (8-10)	Problem defined, but some of the test cases are Unclear (5-7)	Problem statement defined, but unclear test cases (below 5)
2.	Design and implementation	10	Design and implementation are done efficiently (8-10)	Design and implementation are done (5-7)	Design and implementation are incomplete (below 5)
3.	Interpretation of results	10	Results are clearly interpreted & justified (8-10)	Results are interpreted, but limited justification (5-7)	Unclear interpretation (below 5)
4.	Presentation & Communication	10	The presentation is clear and well-structured (8-10)	The presentation is structured, but needs improvement (5-7)	Poorly structured report (below 5)
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Identification	5	Clearly identifies a relevant real-world problem with strong justification (4-5)	Problem identified with adequate explanation (2-3)	Problem identified, but lacks clarity (1)
2.	Innovation & Creativity	10	Highly innovative and unique solution (8-10)	Moderately creative solution (5-7)	Limited innovation (below 5)
3.	Application Design and Implementation	10	User-friendly, effective design and functions effectively with proper coding standards (8-10)	Good design and mostly functional (5-7)	Basic design with limited usability and partially functional (below 5)
4.	Team Collaboration	5	Excellent coordination and equal participation among members (4-5)	Good teamwork with minor imbalance (2-3)	Limited collaboration (1)
5.	Presentation Skills		Clear and confident, presentation (8-10)	Good presentation with minor communication issues (5-7)	Average presentation (below 5)
	Total	40			

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

CO	Theory Component				Percentage Allocation	Mapping Strength
	Test I	Test II	Activity I	Activity II		
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: Strength = 3 (if percentage >20%); Strength =2 (if percentage 10% to 20%);
Strength = 1 (if percentage <10%);

26CSC06	DATA STRUCTURES AND ALGORITHMS		SEMESTER				III	
Prerequisites			Category	ES(PC)	Credits		3	
26CSC01- C PROGRAMMING			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
COURSE OBJECTIVES								
1.	Understand the fundamentals of data structures and algorithms.							
2.	Develop skills in performing operations on different data structures.							
3.	Analyze and select appropriate data structures for different applications.							
4.	Design and implement solutions using data structures and algorithms.							
5.	Apply searching, sorting, and hashing techniques in real-world applications.							
UNIT - I		LINEAR DATA STRUCTURES – LIST						9
Abstract Data Types (ADTs) – List ADT - Array based Implementation - Linked List Implementation – Singly Linked Lists -Circularly Linked Lists - Doubly-Linked Lists - Applications of Lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).								
UNIT - II		LINEAR DATA STRUCTURES –STACKS AND QUEUES						9
Stack ADT - Operations - Applications of Stacks - Evaluating Arithmetic Expression - Conversion of infix to postfix Expression - Queue ADT - Operations - Circular Queue - DeQueue - Applications of Queue.								
UNIT - III		NON-LINEAR DATA STRUCTURES – TREES						9
Tree ADT – Tree traversals – Binary Tree ADT – Expression Trees – Applications of Trees – Binary Search Tree ADT –Threaded Binary Trees- AVL Trees – B-Tree – Heaps - Operations of Heaps - Max Heap - Min Heap - Applications of Heap								
UNIT - IV		NON-LINEAR DATA STRUCTURES – GRAPHS						9
Definition – Representation of Graphs –Types of Graphs - Graph Traversals - Breadth First Search - Depth First Search - Shortest Path Problem: Dijkstra’s Algorithm -Bellman Ford Algorithm- Minimum Spanning Trees: Prim’s Algorithm - Kruskal’s Algorithms.								
UNIT - V		SEARCHING, SORTING AND HASHING TECHNIQUES						9
Searching: Linear Search - Binary Search - Sorting Algorithms - Selection Sort -Insertion Sort - Bubble Sort - Quick Sort - Merge Sort - Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.								
L:45, SL:45, Total:90 Hours								
Weightage: Continuous Assessment 40% End Semester Examinations 60%								
TEXT BOOKS:								
1.	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 4th edition, Pearson Education, 2013.							
2.	Hemant Jain “Problem Solving in Data Structures & Algorithms”, Using C Published by Taaran Technologies Publication,2016.							

Activities:

1.	Article Reviews, Quiz, Assignment, Flipped Class practice, Seminar Presentation, Peer Assessment (CO5)
2.	Project-Based Learning, Case Study Analysis, Simulation Activities (CO6) (Team)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem formulation & selection of data structure	10	Problem is clearly defined and appropriate data structure is correctly chosen	Problem defined, but data structure selection has minor issues	Problem statement defined but incorrect data structure selection
2.	Algorithm design & implementation	10	Efficient algorithm with correct implementation of data structures	Algorithm is correct but has minor implementation issues	Incomplete or incorrect algorithm implementation
3.	Execution & output results	10	Correct execution with accurate output for all test cases	Minor errors in output or test cases	Incorrect or incomplete output
4.	Code quality & documentation	10	Well-structured code with proper comments and documentation	Code is structured but documentation is limited	Poorly structured or undocumented code
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Understanding	10	Clearly understands the problem and selects appropriate data structure	Partially understands the problem	Limited understanding of the problem
2.	Algorithm Design & Logic	10	Correct and efficient algorithm with clear logic	Minor errors in logic or design	Incorrect logic
3.	Implementation (Coding)	10	Correct implementation with proper use of data structures	Minor coding errors	Poor or incomplete implementation
4.	Output & Testing	5	Accurate results with proper test cases	Partially correct output	Incorrect or missing output
5.	Documentation and presentation	5	Well-documented code with explanation and results	Basic documentation	Poor documentation
	Total	40			

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: Strength = 3 (if percentage >20%);

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

26CSC07	OPERATING SYSTEMS		SEMESTER				III
Prerequisites		Category	ES(PC)	Credits			4
NIL		Hours/ Semester	L	T	P	SL	TH
			45	0	30	45	120
COURSE OBJECTIVES							
1.	To provide knowledge of the basics and functions of operating systems						
2.	To understand the process concepts and CPU scheduling algorithms						
3.	To explore the concepts of process synchronization and deadlock handling						
4.	To learn various memory management techniques						
5.	To analyze file systems structures and disk management strategies						
UNIT - I	INTRODUCTION AND OPERATING SYSTEM STRUCTURES						9+6
What Operating System Do, Operating System Structure, Operating System Operations; Process Management, Memory Management, Storage Management, Protection and Security; Operating System Structures - Operating System Services, User and Operating System Interface, System Calls, Types of System Calls.							
Practical:							
1. Installation of Operating system: Windows/ Linux							
2. Illustrate UNIX commands and Shell Programming							
UNIT - II	PROCESS MANAGEMENT						9+6
Process Concepts, Process Scheduling, Operation on Processes; Interprocess Communication- Shared Memory Systems- Message Passing Systems; Threads - Overview, Multithreading Models, Threading Issues; CPU Scheduling - Basic Concepts, Scheduling Criteria, Scheduling Algorithms – First-Come First-Served, Shortest-Job-First, Priority, Round-Robin, Multilevel Queue, Multilevel Feedback Queue.							
Practical:							
1. Write a program for Process Management using System Calls: Fork, Exec, Getpid, Exit, Wait, Close							
2. Implement the various CPU Scheduling Algorithms							
UNIT - III	PROCESS SYNCHRONIZATION AND DEADLOCKS						9+6
Background, The Critical Section Problem, Peterson’s Solution, Synchronization Hardware, Semaphores, Classical Problem of Synchronization, Monitors; Deadlocks - System Model, Deadlock Characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.							
Practical:							
1. Implement the Producer – Consumer problem using semaphores							
2. Write a program to avoid deadlock using Banker’s algorithm							
UNIT – IV	MEMORY MANAGEMENT						9+6
Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table; Virtual Memory – Background, Demand Paging, Page Replacement, Thrashing.							
Practical:							
1. Implement different contiguous memory allocation techniques							
2. Implement various page replacement algorithms							

UNIT - V	FILE SYSTEM AND MASS-STORAGE STRUCTURE	9+6	
File System Structures - File System Implementation: Directory Implementation, Allocation Methods, Free Space Management; Mass-Storage Structure – Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure			
Practical: 1. Implement types of File Allocation methods 2. Implementation of various disk scheduling algorithms			
L:45, P:30, SL:45, Total:120 Hours			
Weightage: Continuous Assessment 50% End Semester Examinations 50%			
TEXT BOOK:			
1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2018.		
REFERENCE BOOKS:			
1.	Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 4th Edition, New Delhi, 2016.		
2.	Harvey M. Deitel, "Operating Systems", Pearson Education, 3rd edition 2018.		
3.	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.		
4.	D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Tata Mc-graw Hill Publishing, 3rd edition, 2017.		
E-RESOURCES:			
1.	https://nptel.ac.in/courses/106106144		
2.	https://archive.org/details/schaumsoutlineof0000harr		
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 and functions of operating systems	--	PSO1
CO2	Apply operating system concepts and techniques to solve system-level and resource management problems.	PO1,PO3	PSO1
CO3	Analyze operating system issues and strategies to assess system performance and effectiveness.	PO2	PSO1
CO4	Conduct practical experiments to implement the functionalities of operating system.	PO4	PSO1
CO5	Assess and justify suitable solutions for real-world problems using operating system concepts through presentation as an individual.	PO2, PO3, PO7, PO9, PO11	PSO1
CO6	Collaborate in teams to investigate operating system concepts, develop solutions for real-world problems, and present the findings through presentation.	PO2, PO8, PO9, PO11	PSO1

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												2		
CO2	3		2									2		
CO3		3										2		
CO4				3								2		
CO5		2	2				1		2		1	2		
CO6		2						2	2		1	2		

Activities:

1.	Solving GATE Questions/Report Submission (CO5)
2.	Case Studies/Presentation (CO6)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Conceptual Understanding	10	Clear Understanding	Minor Conceptual Gaps	Limited understanding
2.	Problem-Solving Approach	15	Systematic and efficient approach with correct methodology	Adequate approach with minor errors	Unclear or inefficient approach
3.	Accuracy & Correctness	10	Correct Solutions with calculation and reasoning	Minor calculation or reasoning errors	Incorrect Solutions
4.	Report Submission	5	Report is clear and well structured	Report is structured, but needs improvement	Poorly structured report
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Identification	10	Clearly defined	Problem identification needs improvement	Limited understanding
2.	Problem Analysis & Solution Design	15	Logical and justified	Adequate	Weak
3.	Team Contribution	10	Effective Collaboration	Uneven	Poor
4.	Presentation & Communication	5	Presentation is clear and well-structured	Presentation needs improvement	Poorly structured
	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			40	40	32	3
CO3	24	24			20	20	22	3
CO4					30	30	15	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%);

26CSC08	JAVA PROGRAMMING LABORATORY	SEMESTER				II	
Prerequisites		Category	ES(PC)	Credits			2
NIL		Hours/ Semester	L	T	P	SL	TH
			0	0	45	15	60
COURSE OBJECTIVES							
1.	To understand the fundamentals of Java programming concepts						
2.	To develop problem-solving skills using Java programming like inheritance, interface and packages, exception handling, multithreading.						
3.	To design and implement Java programs for real-world applications						
4.	To develop a program using advanced java programming concepts such as Java collections, generics, file handling, I/O streams, lambda expressions and streams API						
5.	To improve desktop applications and web development skills through Event handlings, GUI components, java servlets, Apache Tomcat and JDBC Connectivity.						
EXPERIMENTS							
1.	Program using Control structures						
2.	Program using Arrays and Strings						
3.	Program using Java Classes and Objects						
4.	Program to implement Inheritance						
5.	Program to implement Interface						
6.	Program to create Packages and import the package						
7.	Program to create own Exceptions and catch the exceptions						
8.	Program to implement the Multiple threads						
9.	Program to implement File operations						
10.	Program to execute File Copy and Object Serialization operations.						
11.	Program to implement Generic Collections (ArrayList, HashMap) with Lambda filters.						
12.	Program to implement Database CRUD application using JDBC.						
13.	Program to create a Desktop GUI using Swing components and Event handling.						
14.	Program to deploy a Hello World Java Servlet on an Apache Tomcat Server.						
T:45, SL:15, Total:60 Hours							

Weightage: Continuous Assessment 60% End Semester Examinations 40%			
TEXT BOOKS			
1.	Patric Naughton, Herbert Schildt, "The Complete Reference Java2", Twelfth edition, Tata McGraw Hill,2021.		
2.	E.Balaguruswamy, "Programming with Java", Sixth Edition, Tata McGraw Hills, 2019.		
REFERENCE BOOKS:			
1.	CayS.Horstmann, Gary Cornell, "CoreJava2", Twelfth Edition, Pearson Education, 2021.		
2.	Graham Hamilton, Rick Cattell, Maydene Fisher," JDBC Database access with Java".		
3.	Paul Deitel and Harvey Deitel, "Java How to Program", Tenth Edition, Pearson Prentice Hall.		
4.	E. Brown, "Web Development with Node and Express: Leveraging the JavaScript Stack", 2nd edition, O'Reilly Media, 2019.		
E-RESOURCES:			
1.	https://nptel.ac.in/courses/106105191		
2.	https://www.w3schools.com/java/		
3.	https://eclipseide.org/		
4.	https://dev.mysql.com/downloads/mysql/8.0.html		
5.	https://www.hackerrank.com/domains/java		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Familiarize the Java programming concepts	--	
CO2	Apply Java programming concepts for developing applications.	PO1	PSO1
CO3	Investigate and conduct practical experiments to implement java programs.	PO2, PO4	PSO1
CO4	Design and develop Java programs for simple scenarios.	PO5	PSO1
CO5	As an individual, to design java programs for a given requirement and present the solution through a presentation	PO3, PO7, PO9	PSO1
CO6	Collaborate effectively in teams to design, develop, and present a simple Java application that provides a solution to a real-world problem through presentations or hackathons.	PO3, PO6, PO7, PO8, PO9, P10	PSO1

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		
CO3		3		3									3	3
CO4					1								3	3
CO5			2				2		2				3	3
CO6			2			2	2	2	2	2	2	3	3	3
Activities:														
1.	Simple tools design reusable Java utilities using collections, generics, file handling, and stream APIs. (CO4).													
2.	Article Reviews, Quiz, Assignment, Flipped Class practice, Seminar Presentation, Peer Assessment (CO5)													
3.	Project-Based Learning, Case Study Analysis, Simulation Activities (CO6) (Team)													
Rubrics for evaluation: CO5														
Sl. No.	Criterion			Marks	Excellent			Good			Satisfactory			
1.	Define the Problem & Test cases			10	Problem and test cases are clearly defined			Problem defined, but some of the test cases are Unclear			Problem statement defined, but unclear test cases			
2.	Design and implementation			10	Design and implementation are done efficiently			Design and implementation are done			Design and implementation are incomplete			
3.	Interpretation of results			10	Results are clearly interpreted & justified			Results are interpreted, but limited justification			Unclear interpretation			
4.	Presentation & Communication			10	The presentation is clear and well-structured			The presentation is structured, but needs improvement			Poorly structured report			
	Total			40										
Rubrics for evaluation: CO6														
Sl. No.	Criterion			Marks	Excellent			Good			Satisfactory			
1.	Problem Identification			5	Clearly identifies a relevant real-world problem with strong justification			Problem identified with adequate explanation			Problem identified, but lacks clarity			
2.	Innovation & Creativity			10	Highly innovative and unique solution			Moderately creative solution			Limited innovation			

3.	Application Design and Implementation	10	User-friendly, effective design and functions effectively with proper coding standards	Good design and mostly functional	Basic design with limited usability and partially functional
4.	Team Collaboration	5	Excellent coordination and equal participation among members	Good teamwork with minor imbalance	Limited collaboration
5.	Presentation Skills	10	Clear and confident, presentation	Good presentation with minor communication issues	Average presentation
	Total	40			

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

CO	Evaluation of Student Work, Observation of Record and Model Test	Activities	Percentage allocation	Mapping Strength
CO1	10	20	15	1
CO2	20	10	15	3
CO3	20	20	20	3
CO4	20	10	15	1
CO5	20	20	20	2
CO6	10	20	15	2
Total	100	100	100	

Note: Strength = 3 (if percentage >20%);

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

26CSC09	DATA STRUCTURES AND ALGORITHMS LABORATORY		SEMESTER				III
Prerequisites		Category	ES(PC)	Credits			2
26CSC01 -C Programming		Hours/ Semester	L	T	P	SL	TH
			0	0	45	15	60
COURSE OBJECTIVES							
1.	To provide practical understanding of fundamental data structures and algorithms through programming implementations.						
2.	To develop programming skills for performing operations on various linear and non-linear data structures.						
3.	To enhance problem-solving abilities using appropriate data structure and algorithmic techniques.						
4.	To develop the ability to implement efficient solutions for computational and real-world problems.						
5.	To apply searching, sorting, traversal, and hashing techniques in solving real-world applications.						
EXPERIMENTS							
1.	Implementation of List (Single, Doubly, Circular)						
2.	Implementation of Stack						
3.	Implementation of Queue						
4.	Implementation of Binary Search Tree						
5.	Implementation of Tree Traversal						
6.	Implementation of Heap Tree						
7.	Implementation of Breadth First Search Techniques						
8.	Implementation of Depth First Search Techniques						
9.	Implementation of Dijkstra’s Algorithm						
10.	Implementation of Sorting Techniques (Selection Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort)						
11.	Implementation of Searching Techniques (Linear Search & Binary Search)						
12.	Implementation of Hashing Techniques.						
T:45, SL:15, Total:60 Hours							
Weightage: Continuous Assessment 60% End Semester Examinations 40%							
TEXT BOOKS:							
1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 4th edition, Pearson Education, 2013.						
2.	Hemant Jain "Problem Solving in Data Structures & Algorithms", Using C Published by Taaran Technologies Publication, 2016.						

REFERENCE BOOKS:	
1.	Seymour Lipschutz, "Data Structures with C ", published by Tata McGraw-Hill Education Pvt. Ltd., 2015.
2.	Amol M. Jagtap, Ajit S. Mali , "Data Structures using C: A Practical Approach for Beginners", CRC Press,2021.
3.	Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures In C", Second Edition, Silicon Press, 2012.

- | E-RESOURCES: | |
|--------------|---|
| 1. | https://nptel.ac.in/courses/106105085 |
| 2. | https://onlinecourses-archive.nptel.ac.in/noc18_cs25 |
| 3. | https://ocw.mit.edu/courses/6-006-introduction-to-algorithms |
| 4. | https://opendatastructures.org |
| 5. | https://www.tutorialspoint.com/data_structures_algorithms |

1.	https://nptel.ac.in/courses/106105085
2.	https://onlinecourses-archive.nptel.ac.in/noc18_cs25
3.	https://ocw.mit.edu/courses/6-006-introduction-to-algorithms
4.	https://opendatastructures.org
5.	https://www.tutorialspoint.com/data_structures_algorithms

COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Familiarize the concepts, types, and operations of various data structures and algorithms.	--	--
CO2	Apply suitable data structure techniques to develop efficient programs for computational problems.	PO1	PSO1, PSO2
CO3	Analyze different data structures and algorithms based on their performance and applications.	PO2, PO3	PSO1, PSO2
CO4	Develop efficient programs for real-world problem solving using appropriate data structures and algorithms.	PO5	PSO1, PSO3
CO5	Implement data structure algorithms individually and document the program results effectively.	PO6, PO9, PO10, PO11	PSO1, PSO2, PSO3
CO6	Collaborate effectively in teams to design, develop, and present a simple application that provides a solution to a real-world problem through presentations or hackathons.	PO6, PO9, PO10, PO11	PSO1, PSO2, PSO3

The Course Articulation Matrix (CAM) for defined COs

[illegible]

Activities:

1.	Simple programming activities to implement data structures and algorithms using C. (CO4)
2.	Article Reviews, Quiz, Assignment, Flipped Class practice, Seminar Presentation, Peer Assessment (CO5)
3.	Project-Based Learning, Case Study Analysis, Simulation Activities (CO6) (Team)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem formulation & selection of data structure	5	Problem is clearly defined and appropriate data structure is correctly chosen	Problem defined, but data structure selection has minor issues	Problem statement defined but incorrect data structure selection
2.	Algorithm design & implementation	5	Efficient algorithm with correct implementation of data structures	Algorithm is correct but has minor implementation issues	Incomplete or incorrect algorithm implementation
3.	Execution & output results	5	Correct execution with accurate output for all test cases	Minor errors in output or test cases	Incorrect or incomplete output
4.	Code quality & documentation	5	Well-structured code with proper comments and documentation	Code is structured but documentation is limited	Poorly structured or undocumented code
	Total	20			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Understanding	3	Clearly understands the problem and selects appropriate data structure	Partially understands the problem	Limited understanding of the problem
2.	Algorithm Design & Logic	4	Correct and efficient algorithm with clear logic	Minor errors in logic or design	Incorrect logic
3.	Implementation (Coding)	5	Correct implementation with proper use of data structures	Minor coding errors	Poor or incomplete implementation
4.	Output & Testing	3	Accurate results with proper test cases	Partially correct output	Incorrect or missing output
5.	Documentation and presentation	5	Well-documented code with explanation and results	Basic documentation	Poor documentation
	Total	20			

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	10	10	10	1
CO2	20	20	20	3
CO3	20	20	20	3
CO4	20	10	15	1
CO5	20	20	20	2
CO6	10	20	15	2
Total	100	100	100	

Note: 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 behavior, 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	-	-	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)			Mapping POs	Mapping PSOs
At the end of the course, the students will have the ability to				
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	--
CO4	Examine harmony in family and society by understanding values in human relationships, justice, trust, respect, fearlessness, prosperity, co-existence, and universal harmonious order.		PO8	--

CO5	Evaluate harmony in nature and existence by understanding interconnectedness, mutual fulfilment, recyclability, self-regulation, and holistic perception of coexistence at all levels.	PO6	--
CO6	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
CO1														
CO2						2								
CO3							2							
CO4								1						
CO5						3								
CO6											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: CO5

Sl. No.	Criterion	Marks	Excellent (9-10)	Good (6-8)	Satisfactory (1-5)
1.	Understanding harmony in nature	10	Clearly explains harmony, inter connectedness, 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: 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, <i>*The Pretotyping Manifesto*</i> , 2009
2.	https://sites.google.com/a/pretotyping.org/www/the-pretotyping-manifesto
3.	Jazz Factory, <i>*All About Presentations*</i> , 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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/

[illegible]

The Course Articulation Matrix (CAM) for defined Cos

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			

REFERENCE BOOKS:			
1.	Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4 th Edition, Pearson Education, New Delhi, 2007.		
2.	Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2006.		
3.	Seymour Lipschutz and Marc Lipson, "Discrete Mathematics" Schaum's Outlines, 3 rd Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2010.		
E-RESOURCES:			
1.	NPTEL, "Discrete Mathematics", National Programme on Technology Enhanced Learning, https://nptel.ac.in/courses/106103205		
2.	MIT Open Course Ware, "Mathematics for Computer Science", Massachusetts Institute of Technology, https://ocw.mit.edu/courses/6-042j-mathematics-for-computer-science-fall-2010/		
3.	Khan Academy, "Discrete Mathematics and Combinatorics", https://www.khanacademy.org/standards/NC.Math/DCS.N		
4.	Geeks for Geeks, "Discrete Mathematics Tutorial", https://www.geeksforgeeks.org/engineering-mathematics/discrete-mathematics-tutorial/		
5.	Wolfram MathWorld, "Discrete Mathematics, Graph Theory, Lattices and Boolean Algebra", Wolfram Research, https://mathworld.wolfram.com/DiscreteMathematics.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 discrete mathematics including logic and proofs, combinatorics, graph theory, algebraic structures, lattices and Boolean algebra and explain their basic principles, properties and applications in mathematical and computing problems.	--	--
CO2	Apply the concepts and techniques of discrete mathematics including logical reasoning, proof methods, combinatorial counting, recurrence relations, graph models, algebraic structures, lattices, and Boolean algebra to solve mathematical, computing and engineering-related problems.	PO1	PSO1, PSO2
CO3	Analyze discrete mathematical problems using logic, proof techniques, combinatorial methods, recurrence relations, graph theory, algebraic structures, lattices and Boolean algebra by selecting suitable methods and interpreting the results in mathematical and computing applications.	PO2	PSO1
CO4	Develop mathematical models and solution strategies using discrete mathematics concepts such as logic, proof methods, combinatorics, recurrence relations, graph theory, algebraic structures, lattices and Boolean algebra for solving computing engineering-related problems.	PO3	PSO1, PSO2
CO5	Utilize discrete mathematical tools and computational techniques for solving problems related to logic, combinatorics, graph theory, algebraic structures, lattices and Boolean algebra in computing and engineering applications.	PO5	PSO2
CO6	Communicate discrete mathematical concepts, proof procedures, graph-based solutions, combinatorial arguments, and Boolean algebra applications effectively through proper notation, assignments, presentations and structured report writing.	PO10	--

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		2										2		
CO4			1									1	1	
CO5					3								2	
CO6										3				
Avg	3	2	1		3					3		2	2	

Activities:

1.	Students shall solve selected problems from logic, combinatorics, graph theory, algebraic structures, lattices and Boolean algebra using suitable computational tools or open-source software. This activity develops the ability to apply discrete mathematical tools and computational techniques in computing and engineering applications.
2.	Students shall prepare a short report or presentation on selected applications of discrete mathematics such as graph models, recurrence relations, Boolean algebra, proof techniques or algebraic structures. This activity develops the ability to communicate mathematical concepts, proof procedures, graph-based solutions and logical arguments effectively.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Selection of problem	8	Suitable discrete mathematics problem is selected and clearly understood	Problem is relevant, but needs minor clarity	Problem selection is basic or unclear
2.	Application of discrete mathematical technique	8	Correct technique is applied with proper logical steps	Technique is mostly correct with minor errors	Technique is incomplete or incorrect
3.	Use of computational/ logical tool	8	Tool or method is used effectively with accurate results	Tool/method is used with minor errors	Tool/method usage is limited or unclear
4.	Interpretation of results	8	Results are clearly interpreted with computing/engineering relevance	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 explanation	8	Concepts, proof steps and procedures are clearly explained	Explanation is understandable with minor gaps	Explanation is unclear
2.	Use of notation and representation	8	Proper notation, truth tables, graphs, diagrams or Boolean expressions 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, conclusions and applications 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	-	20	2
CO6	-	-	-	40	20	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%);

26CSC10	DESIGN AND ANALYSIS OF ALGORITHMS	SEMESTER				IV	
Prerequisites		Category	ES(PC)	Credits		3	
26CSC06-DATA STRUCTURES AND ALGORITHMS		Hours/ Semester	L	T	P	SL	TH
			45	0	0	45	90
COURSE OBJECTIVES							
1.	To understand the fundamental concepts of algorithms, including design principles, asymptotic notations, and time and space complexity analysis						
2.	To apply divide and conquer and greedy strategies to solve computational problems such as sorting, searching, graph algorithms, and optimization problems.						
3.	To design and implement dynamic programming techniques for solving complex problems like shortest paths, knapsack, and sequence optimization						
4.	To apply appropriate backtracking algorithmic strategies to solve combinatorial and optimization problems and evaluate algorithm efficiency in terms of correctness, time complexity, and space complexity.						
5.	To Analyze algorithms by evaluating time and space complexity, correctness and NP-completeness characteristics under different computational constraints.						
UNIT - I		FUNDAMENTALS OF ALGORITHMS AND COMPLEXITY ANALYSIS					9
The Role of Algorithms in Computing - Analyzing Algorithms - Designing Algorithms - Growth of Functions - Asymptotic Notations - Standard notations and common functions - Recurrences - The Substitution Method - The Recursion-tree Method - The Master Method.							
UNIT - II		DIVIDE-AND-CONQUER AND THE GREEDY METHOD					9
Divide and Conquer - General Method - Linear Search - Binary Search - Finding Maximum and Minimum - Merge Sort - Quick Sort. Greedy Algorithms - General Method - Container Loading - Knapsack Problem - Tree Vertex Splitting - Job Sequencing with Deadlines - Minimum-Cost Spanning Trees (Prim’s and Kruskal’s Algorithm).							
UNIT - III		DYNAMIC PROGRAMMING METHOD					9
Dynamic Programming - General Method - Multistage Graphs - All-Pair Shortest Paths - Optimal Binary Search Trees - 0/1 Knapsack - Travelling Sales Person Problem.							
UNIT -IV		BACKTRACKING METHOD					9
Backtracking: General Method – 8 Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Knapsack problems.							
UNIT - V		GRAPH TRAVERSALS AND BRANCH AND BOUND					9
Graph Traversals: Techniques for Graphs (BFS and DFS) - Connected Components and Spanning Trees – Biconnected components. Branch and Bound: General Methods (FIFO & LC) – 0/1 Knapsack problem – Introduction to NP-Hard and NP-Complete Problems - Basic concepts, Cook’s Theorem.							
L:45, T:0, SL:45, Total:90 Hours							
Weightage: Continuous Assessment 40% End Semester Examinations 60%							
TEXT BOOKS:							
1.	T. Cormen, C. Lieserson, R. Rivest, C. Stein, "Introductions to Algorithms", Third Edition, Prentice-Hall/India, 2009.						

REFERENCE BOOKS:

- | | |
|----|---|
| 1. | Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Universities Press Pvt. Ltd., 2012 |
| 2. | M. Tenenbaum, Augestien, "Data Structures using C", Third Edition, Pearson Education, 2007 |

E-RESOURCES:

- | | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs67 |
| 2. | https://nptel.ac.in/courses/106106131 |

COURSE OUTCOMES (COs) /

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

Mapping POs

Mapping PSOs

C01

Explain the fundamental concepts of algorithm and computational complexity

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—

CO2

Apply divide and conquer, greedy, and dynamic programming techniques to solve computational problems and evaluating their efficiency in terms of time and space complexity and selecting appropriate algorithmic strategies for different problem scenarios.

P01, P02,
P03

PSO1,
PSO2

C03

Analyze backtracking, graph traversal, and branch and bound techniques to solve combinatorial, graph-based, optimization problems and NP-hard and NP-complete problem concepts

PO1, PO2,
PO3, PO5,
PO11

PSO1,
PSO2

C04

Conduct practical experiments to design, implement, and analyze various algorithmic techniques for solving computational and optimization problems, and to evaluate their efficiency and computational complexity.

P01, P02,
P03, P05

PSO1,
PSO3

C05

Analyze and compare algorithm performance effectively through seminars, technical presentations, or quiz-based academic activities as an individual

P02, P03,
P07, P09

PS01,
PS02,
PS03

C06

Collaborate effectively in a team to investigate various algorithm techniques for real-world computational and optimization problems

PO2, PO8,
PO9, PO10

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														
C02	3	3	3									3	3	
C03	2	2	2		2						3	1	1	
C04	2	2	2		3							2		2
C05		2	2				2		3			2	2	2
C06		2						3	2	2		2	2	2

Activities: Modes of Assessment Activities

- | | |
|----|--|
| 1. | Seminar / Quiz / Technical Presentation Activities on DAA concepts (CO5) |
| 2. | Team-Based analysis of an algorithm Activities (CO6) |

Rubrics for evaluation: CO5					
Sl. No.	Criterion	Marks	Excellent (7-8)	Good (4-6)	Satisfactory (1-3)
1.	Understanding the Concepts of DAA	25	Demonstrates strong understanding of DAA concepts	Demonstrates moderate understanding	Basic understanding
2.	Clarity of Communication	25	Explains concepts clearly and confidently	Explains with minor difficulty	Limited clarity in explanation
3.	Capability of analyzing skill of an algorithm	20	Demonstrates strong analytical skill and thinking	Demonstrates moderate reasoning	Limited reasoning ability
4.	Presentation Skills	15	Well organized and engaging presentation	Moderately organized presentation	Limited presentation effectiveness
5.	Participation and Preparedness	15	Highly active and well prepared	Moderately prepared	Limited participation
	Total	100			

Rubrics for evaluation: CO6					
Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Team Participation and Collaboration	25	Actively contributes and collaborates effectively with team members	Participates with moderate contribution	Limited participation in team activities
2.	Analysis of algorithm performance ability	25	Develops effective query for solutions	Develops acceptable solutions	Incomplete/problematic solutions
3.	Application of DAA	20	Correctly applies DAA concepts	Minor conceptual errors	Significant conceptual errors
4.	Creativity and Innovation	15	Demonstrates innovative approach	Shows moderate creativity	Limited creativity
5.	Presentation and Demonstration	15	Clearly explains demonstrates the solution confidently	Provides moderate explanation	Limited explanation
	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	15				8	2
CO2	25	15	20		30	3
CO3		25		20	22	2
CO4	20	20			20	2
CO5			20		10	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%);

26CS401	THEORY OF COMPUTATION			SEMESTER			IV	
Prerequisites			Category	ES(PC)	Credit		3	
26CSC06- DATA STRUCTURES AND ALGORITHMS			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
Course Objectives:								
1.	To introduce the fundamental concepts of automata theory, formal languages, and computational models.							
2.	To develop the ability to construct and analyze finite automata and regular expressions for language recognition problems.							
3.	To understand formal grammars, context free languages, and their applications in syntactic analysis.							
4.	To apply pushdown automata and context free grammar concepts in the design and analysis of computational systems.							
5.	To understand the principles, capabilities, and limitations of Turing machines and computability theory.							
6.	To analyze decidability, computational complexity, and NP-complete problems in theoretical computer science.							
UNIT - I		FUNDAMENTALS OF AUTOMATA THEORY						9
Introduction to Finite automata: structural representations-Automata and Complexity-the central concepts of Automata Theory- Alphabets, Strings, Languages and Problems. Nondeterministic Finite Automata: Formal definition, an application-Text Search-Finite automata with Epsilon-Transitions. Deterministic Finite Automata: Definition of DFA, Processing Strings-The language of DFA-Conversion of NFA with ϵ -transitions to NFA without ϵ -transitions. Conversion of NFA to DFA.								
UNIT - II		REGULAR LANGUAGES AND THEIR PROPERTIES						9
Regular Languages: Regular Sets, Regular Expressions-Identity Rules-Constructing Finite Automata for a given Regular Expressions-Conversion of Finite Automata to Regular Expressions. Decision and closure properties of regular languages, Minimization of DFA- Table Filling Algorithm, Pumping Lemma for Regular Languages.								
UNIT - III		GRAMMARS AND NORMAL FORMS						9
Grammar Introduction- Types of Grammar- Chomsky Hierarchy-Conversion of DFA to Regular Grammar- Context Free Grammars (CFG) and Languages- Derivations and Languages-Ambiguous Grammar- Derivation Tree – Simplification of CFG- Chomsky Normal Form (CNF)- Greibach Normal Form (GNF)								
UNIT - IV		PUSHDOWN AUTOMATA						9
Pushdown Automata- Definition-Model-Acceptance of CFL, Acceptance by Final state and Acceptance by Empty stack and its equivalence -Deterministic Pushdown Automata – Equivalence of CFG and PDA- Pumping Lemma for CFG- Decision and Closure properties of context-free								
UNIT - V		TURING MACHINES AND UNDECIDABILITY						9
Turing Machine: Turing machine, definition, Model, Design of TM, Types of Turing machine- Multi head and Multi tape Turing machines- The Halting Problem- Recursive and Recursively Enumerable Languages. Decidability and undecidability- Complexity classes of P and NP- NP-Complete Problems-Cook's Theorem.								
Total (45 L+ 45 SL) = 90 Hours								
Weightage:								
Continuous Assessment 40%, End Semester Examination 60%								

TEXT BOOKS:														
1.	John Hopcroft, Rajeev Motwani, and Jeffrey Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education, 2014.													
2.	Peter Linz, "An Introduction to Formal Languages and Automata", Fifth edition, 2012.													
REFERENCE BOOKS:														
1.	Kamala Krithivasan and Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson Education, 2009.													
2.	S. N. Sivanandam and M. Janaki Meena, "Theory of Computation", I.K. International Publishing House Pvt. Ltd., New Delhi, 2009.													
3.	Mishra K L P and Chandrasekaran N, Theory of Computer Science Automata, Languages and Computation, Third Edition, Prentice Hall of India, 2004.													
E-RESOURCES:														
1.	https://nptel.ac.in/courses/106104028/													
2.	http://www.nptelvideos.in/2012/11/theory-of-computation.html													
3.	http://infolab.stanford.edu/~ullman/ialc.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 concepts, computational models, formal languages, and theoretical foundations used in the theory of computation.											--	PSO1	
CO2	Apply automata, formal grammar, pushdown automata, and Turing machine concepts to model and solve language recognition and computational problems.											PO1		
CO3	Analyze formal languages and computational problems to determine properties, equivalence, computability, decidability, and complexity characteristics.											PO2		
CO4	Evaluate computational models and develop suitable solutions for language recognition and complex computational problems using automata theory concepts.											PO3		
CO5	Illustrate the applications of Theory of Computation concepts in solving computational problems through individual learning activities.											PO6, PO9, PO11		
CO6	As a member of a team, analyze computational problems, develop, implement and demonstrate suitable solutions using appropriate computational models, techniques, and tools, and effectively present the outcomes while abiding by ethics.											PO5, PO8, PO11		
Course Articulation Matrix (CAM) for defined COs														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	2	-	-	2	-	2	2	-	-
CO6	-	-	-	-	2	-	-	2	-	-	2	2	-	-

Activities:	
1.	Individual Seminar / Quiz / Technical Presentation Activities on Automata and Formal Languages (CO5)
2.	Team-Based Problem Solving / Computational Model Design Activities (CO6)

Rubrics for evaluation: CO5					
Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Conceptual Understanding	15	Demonstrates thorough understanding of Theory of Computation concepts with accurate responses	Demonstrates moderate understanding with a few conceptual errors.	Demonstrates limited understanding with several conceptual errors.
2.	Application of Concepts	10	Correctly applies TOC concepts to solve computational problems	Applies concepts with occasional errors.	Unable to apply concepts effectively
3.	Analytical Ability	10	Accurately analyzes automata, grammars, and computational models.	Performs basic analysis with minor errors.	Demonstrates limited analytical ability.
4.	Accuracy of Responses	5	Provides consistently accurate answers with minimal or no errors.	Provides partially correct answers with some errors.	Provides mostly incorrect or incomplete answers.
	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 effective computational solutions	Develops acceptable solutions	Incomplete / problematic solutions
3.	Application of Computational Models	10	Correctly applies automata/grammar/TM concepts	Minor conceptual errors	Significant conceptual errors
4.	Presentation and Demonstration	10	Clearly explains and demonstrates the solution confidently	Provides moderate explanation	Limited explanation
	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: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10)

26CSC11	PYTHON FOR DATA SCIENCE			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 introduce the fundamentals of Python programming, including data types, control structures, functions, and file handling for solving computational problems.								
2.	To develop the ability to use Python data structures and libraries for storing, processing, and manipulating data effectively.								
3.	To provide knowledge of statistical concepts and data preprocessing techniques for describing and analyzing datasets.								
4.	To enable students to perform data wrangling and data analysis uses NumPy and Pandas libraries.								
5.	To develop skills in visualizing and interpreting data using Matplotlib and Seaborn for effective data-driven decision making.								
UNIT – I		INTRODUCTION TO PYTHON							9
Features of Python – Variable, Data Types, Input and Output Statements – Operators and Expressions, Statements – Decision making and looping statements – Functions and Modules – Strings : Operations and Methods									
UNIT – II		PYTHON DATA STRUCTURES							9
List: list slices, list methods, list alias and cloning, list comprehension – Tuple and its operations – Tuple and its operations – Set and its operations – Dictionaries and its operations – Exception Handling – File Handling – Reading and Writing CSV/Text Files									
UNIT – III		DESCRIBING DATA & RELATIONSHIPS							9
Introduction to Datasets and Data Types - Facets of data – Data Preprocessing – Basic Statistical descriptions of Data – Types of Data – Describing Data with Averages – Normal Distribution and standard (z) scores - Correlation coefficient for quantitative data – Regression for quantitative data – multiple regression.									
UNIT – IV		DATA WRANGLING							9
Basics of Numpy arrays – aggregations – computations on arrays: comparisons, masks, boolean logic – fancy indexing – sorting – handling structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – handling missing data – combining datasets – aggregation and grouping – pivot tables									
UNIT - V		DATA VISUALIZATION							9
Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots Histograms – legends – colors – subplots – text and annotation – customization – 3D plotting – Visualization with Seaborn.									
L:45, SL:45, Total:90 Hours									
Weightage:									
Continuous Assessment: 40%									
End Semester Examinations: 60%									

TEXT BOOKS:			
1.	Reema Thareja, "Python Programming using Problem Solving Approach", 3 rd Edition, Oxford University Press, New Delhi, 2020. (Unit I, II)		
2.	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017 (Unit III)		
3.	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016 (Unit IV, V)		
REFERENCE BOOKS:			
1.	Davy Cielen, Arno D. B. Meysman, Mohamed Ali , "Introducing Data Science – Big Data, Machine Learning and more, Using Python Tools", Manning Publications, 2016		
2.	Joel Grus, "Data Science from the Scratch", O'Reilly, 2015		
3.	Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter ", 3rd Edition, O'Reilly Media, 2022.		
4.	Fabio Nelli, "Python Data Analytics: Data Analysis and Science Using Pandas, Matplotlib and the Python Programming Language", 3rd Edition, Apress, 2023.		
5.	Yuli Vasiliev, "Python for Data Science: A Hands-on Introduction", No Starch Press, 2022.		
E-RESOURCES:			
1.	https://www.python.org/		
2.	https://docs.python.org/3/tutorial/datastructures.html		
3.	https://numpy.org/doc/2.4/reference/index.html		
4.	https://www.khanacademy.org/math/statistics-probability		
5.	https://matplotlib.org/stable/tutorials/index.html		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Interpret the fundamental concepts, principles, and techniques related to programming and data analysis.	-	-
CO2	Implement appropriate programming constructs, analytical techniques and visualization method for effective data processing.	PO1, PO2,PO3, PO5, P11	PSO1, PSO2, PSO3
CO3	Examine datasets and computational outputs to identify patterns, trends, and relationships.	PO1, PO2,PO3, PO4, PO5, P11	PSO1, PSO2, PSO3
CO4	Design suitable data-oriented solutions and visual representations using computational tools and analytical techniques.	PO1, PO2,PO3, PO4,PO5, PO9, P11	PSO1, PSO2, PSO3
CO5	Demonstrate individual competency in applying programming and data analysis methods for solving computational tasks.	PO1, PO2,PO3, PO4,PO5, PO9, P11	PSO1, PSO2, PSO3
CO6	Collaborate effectively as a team to apply suitable computational and analytical techniques for solving real-world data problems.	PO1, PO2,PO3, PO4, PO5,PO8, PO9, P11	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	3	-	-	-	-	-	1	3	1	2
CO3	3	3	3	3	3	-	-	-	-	-	1	2	1	3
CO4	3	3	3	3	3	-	-	-	1	-	1	2	2	3
CO5	3	3	3	3	3	-	-	-	3	-	1	3	2	2
CO6	3	3	3	3	3	-	-	3	2	-	1	2	2	3
PAM	3	3	3	3	3	-	-	3	2	-	1	2.4	1.6	2.6

Activities:

1.	Development of application-oriented solutions using basic programming constructs, data manipulation, and analytical techniques through mini projects, assignments, project-based learning, and peer assessment activities.
2.	Hands-on learning activities involving dataset preprocessing, statistical interpretation, and data visualization through flipped classroom practices, programming challenges, tests, and quizzes.
3.	Case study and collaborative team-based activities focused on dataset analysis and visualization to solve real-world computational problems and derive meaningful insights through case study analysis, team presentations, and peer evaluation.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Understanding and Solution Design	8	Clearly understands the problem and develops an effective analytical solution	Understands the problem with minor issues in solution design	Limited understanding of the problem and incomplete solution design
2.	Data Preparation and Processing	6	Data is properly cleaned, organized, and processed effectively	Minor issues in data preparation and processing	Incomplete or incorrect data processing
3.	Programming Logic and Implementation	8	Program is logically structured and implemented correctly without errors	Implementation is mostly correct with minor logical or coding issues	Incomplete or incorrect implementation
4.	Statistical Analysis and Visualization	6	Performs accurate analysis and creates meaningful visualizations effectively	Analysis and visualization are mostly correct with minor issues	Incomplete or incorrect analysis and visualization
5.	Creativity and Problem-Solving Approach	6	Demonstrates innovative and efficient problem-solving techniques	Shows acceptable problem-solving approach with limited creativity	Limited attempt in problem solving and solution development

6.	Presentation and Interpretation of Results	6	Presents results clearly with proper interpretation and explanation	Presentation is adequate with limited interpretation	Presentation lacks clarity and interpretation
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Analysis and Task Distribution	8	Analyzes the problem effectively and distributes tasks appropriately among members	Moderate analysis and task allocation are adequate with minor issues	Incomplete problem analysis and ineffective task distribution
2.	Application of Computational Techniques	8	Applies suitable programming and analytical techniques effectively in team activities	Techniques are applied adequately with minor implementation issues	Limited or incorrect application of techniques
3.	Dataset Analysis and Interpretation	8	Performs meaningful dataset analysis and derives accurate interpretations collaboratively	Analysis and interpretation are mostly correct with minor issues	Incomplete or incorrect analysis and interpretation
4.	Visualization and Presentation of Findings	8	Presents analytical findings and visualizations clearly and effectively as a team	Presentation and visualization are adequate with minor clarity issues	Presentation lacks clarity and effective visualization
5.	Innovation and Team Problem-Solving	8	Demonstrates creative ideas and effective collaborative problem-solving approaches	Shows acceptable teamwork and problem-solving ability	Limited innovation and weak collaborative problem-solving
	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	34	08	-	-	21	3
CO3	-	26	-	-	13	2
CO4	16	16	-	-	16	3
CO5	-	-	40	-	20	3
CO6	-	-	-	40	20	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%);

26CSC12	DATABASE MANAGEMENT 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 and explain the fundamental concepts of database management systems						
2.	To apply relational database concepts to design and implement efficient database solutions for real-world applications.						
3.	To apply relational database design principles, normalization techniques, and functional dependency concepts for developing efficient database schemas.						
4.	To analyze transaction processing, concurrency control, and recovery mechanisms to ensure database consistency, reliability, and integrity.						
5.	To apply advanced database concepts including distributed databases, object-oriented databases, data warehousing, data mining, and information retrieval to design and manage efficient database systems for real-world applications.						
UNIT - I		INTRODUCTION TO DATABASE SYSTEMS					9
Introduction to database systems – Purpose of database systems – Views of data – Data models – Database management system – Three-schema architecture – Components of DBMS – Entity Relationship model – Entities, attributes, relationships – E/R diagram notation – Conceptual database design – Applications of E/R modeling.							
UNIT - II		RELATIONAL MODEL AND SQL					9
Relational data model – Relations, schemas, keys and integrity constraints – Referential integrity and foreign keys – Relational algebra operations – Introduction to SQL – Data definition and manipulation – Queries in SQL – Aggregate functions – Group by and having clauses – Embedded SQL.							
UNIT - III		DATABASE DESIGN AND NORMALIZATION					9
Functional dependencies – Armstrong’s axioms – Closure and minimal cover – Normalization concepts – First, Second, Third Normal Forms and BCNF – Decomposition properties – Algorithms for normalization – Fourth and Fifth Normal Forms.							
UNIT - IV		TRANSACTION PROCESSING AND RECOVERY					9
Transaction processing concepts – ACID properties – Concurrency control techniques – Lock-based protocols – Error recovery and logging – Undo and redo operations – Database Recovery – Recovery Concepts - Deferred Update- Immediate Update- Shadow Paging- ARIES recovery algorithm.							
UNIT - V		STORAGE AND INDEXING TECHNIQUES AND ADVANCED DATABASES					9
File organization methods – Indexing concepts – Primary and secondary indexes – Hash-based indexing – Dynamic hashing techniques – Multi-level indexing – B+ tree indexing. Advanced Databases: Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL – Data Warehousing and Data Mining- Information Retrieval							
L:45, T:0, SL:45, Total:90 Hours							

Weightage:

Continuous Assessment 40%

End Semester Examinations 60%

TEXT BOOKS:

- | | |
|----|---|
| 1. | Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, 7th Edition, McGraw Hill, 2019. |
| 2. | C. J. Date, A. Kannan and S. Swamynathan, An Introduction to Database Systems, 8th Edition, Pearson Education, 2006 |

REFERENCE BOOKS:

- | | |
|----|--|
| 1. | Ramez Elmasri and Shamkant B. Navathe, <i>Fundamentals of Database Systems</i> , 7th Edition, Pearson Education, 2017. |
| 2. | Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2003 |
| 3. | S. K. Singh, Database Systems: Concepts, Design and Applications, 2nd Edition, Pearson Education, 2006. |

E-RESOURCES:

- | | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs39 |
| 2. | https://nptel.ac.in/courses/106105175 |

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

CO1	Understand and explain the fundamental concepts of database management systems	--	--
CO2	Apply relational database concepts to design and implement efficient database solutions for real-world applications.	PO1, PO2, PO3	PSO1
CO3	Analyze database systems by evaluating schema design, normalization, query optimization and distributed database performance under different operational constraints.	PO1, PO2, PO5, PO11	PSO3
CO4	Analyze the general idea of data storage, indexing techniques and query processing and develop a simple database for applications using advanced databases.	PO1, PO3, PO5	PSO2
CO5	Communicate concepts related to the database management effectively through seminars, technical presentations, or quiz-based academic activities as an individual	PO7,PO9	PSO3
CO6	Collaborate effectively as a team to apply suitable database tools techniques for solving real-world database applications	PO8, PO10	PSO2

The Course Articulation Matrix (CAM) for defined COs

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

Activities: Modes of Assessment Activities

1.	Seminar / Quiz / Technical Presentation Activities on Advanced Database techniques (CO5)
2.	Team-Based real - time application development and design Activities (CO6)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Understanding of DBMS Concepts	25	Demonstrates strong understanding of DBMS concepts	Demonstrates moderate understanding	Basic understanding
2.	Clarity of Communication	25	Explains concepts clearly and confidently	Explains with minor difficulty	Limited clarity in explanation
3.	Technical Content Organization	20	Demonstrates strong analytical thinking	Demonstrates moderate reasoning	Limited reasoning ability
4.	Presentation Skills	15	Well organized and engaging presentation	Moderately organized presentation	Limited presentation effectiveness
5.	Participation and Preparedness	15	Highly active and well prepared	Moderately prepared	Limited participation
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Team Participation and Collaboration	25	Actively contributes and collaborates effectively with team members	Participates with moderate contribution	Limited participation in team activities

2.	Problem Solving Ability	25	Develops effective query for solutions	Develops acceptable solutions	Incomplete/problematic solutions
3.	Application of DBMS	20	Correctly applies DBMS concepts	Minor conceptual errors	Significant conceptual errors
4.	Creativity and Innovation	15	Demonstrates innovative approach	Shows moderate creativity	Limited creativity
5.	Presentation and Demonstration	15	Clearly explains and demonstrates the solution confidently	Provides moderate explanation	Limited explanation
	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	15		24	3
CO3	24	24	10		24	3
CO4				20	10	2
CO5			15		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%);

26CSC14	DATABASE MANAGEMENT SYSTEMS LABORATORY		SEMESTER				IV
Prerequisites		Category	ES(PC)	Credits			2
NIL		Hours/ Semester	L	T	P	SL	TH
			0	0	45	15	60
COURSE OBJECTIVES							
1.	To provide practical implementations of fundamental database concepts using SQL.						
2.	To develop database applications using queries, procedures, and triggers.						
3.	To develop the ability of database connectivity with front-end applications.						
4.	To develop the ability to implement efficient solutions for advanced database programming concepts.						
5.	To familiarize learners with modern tools, technologies, and application-based solutions.						
EXPERIMENTS							
(Implement the following using Python/TensorFlow/PyTorch)							
1.	Create a relational data base system using DDL commands with constraints.						
2.	Update the data base system using DML commands and working with DCL commands.						
3.	Implementation of SQL functions and operators.						
4.	Nested queries and join operations						
5.	Views and set operators in SQL						
6.	Control structures						
7.	Procedures and functions						
8.	Triggers and exception handling						
9.	Dynamic and embedded SQL						
10.	Database mini project design and implementation						
T:45, SL:15, Total:60 Hours							
Weightage:							
Continuous Assessment 60%							
End Semester Examinations 40%							
REFERENCE BOOKS:							
1.	Abraham Silberschatz, Henry F. Korth, and S.Sudharshan, "Database System Concepts",6th edition, Tata McGraw Hill, 2011						
2.	Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 4th Edition, Pearson/Addision wesley, 2007						
3.	C. J. Date, A. Kannan and S. Swamynathan, An Introduction to Database Systems, 8th Edition, Pearson Education, 2006						
4.	S. K. Singh, Database Systems: Concepts, Design and Applications, 2nd Edition, Pearson Education, 2006.						

E-RESOURCES:

COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Design and create relational database systems using DDL commands with appropriate constraints to ensure data integrity and consistency.	--	--
CO2	Manipulate and manage database contents using DML, DCL commands, SQL functions, operators, and control structures effectively.	PO1	PSO1, PSO2
CO3	Apply advanced SQL techniques such as nested queries, joins, views, and set operators to retrieve and process complex data efficiently.	PO2, PO3	PSO1, PSO2
CO4	Develop database applications using procedures, functions, triggers, exception handling, and dynamic/embedded SQL for real-world problem solving.	PO5	PSO1, PSO3
CO5	Analyze and optimize database operations by implementing structured queries and evaluating their performance in different application scenarios.	PO6, PO9, PO10, PO11	PSO1, PSO2, PSO3
CO6	Design, implement, document, and collaboratively develop database mini projects by applying appropriate DBMS concepts and testing database-driven solutions for practical applications.	PO6, PO9, PO10, PO11	PSO1, PSO2, PSO3

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	2		2									2	2	
C03		2										2	2	
C04	2	2	2								2	2		2
C05	2	2	2			2	2				2	2	2	2
C06		2	2			2	2	2	2	2	2	2	2	2

Activities:

1.	Simple SQL programming activities to design and implement relational database operations using DDL, DML, DCL commands, SQL functions, joins, and nested queries. (CO4)
2.	Article Reviews, Quiz, Assignment, Flipped Class practice, Seminar Presentation, Peer Assessment (CO5)
3.	Project-Based Learning, Case Study Analysis, Simulation Activities and mini project development (CO6) (Team)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Query Design and Correctness	10	Ability to write accurate and logically correct SQL queries	Ability to write accurate and logically minor issues SQL queries	Ability to write accurate and logically incorrect SQL queries
2.	Use of Advanced SQL Features	10	Effective implementation of query with correct implementation	Effective implementation of query but has minor implementation issues	Effective implementation of query but incorrect SQL implementation
3.	Query Optimization and Performance Analysis	10	Ability to analyze query execution and apply optimization techniques	Ability to analyze query execution but not able to apply optimization techniques	Ability to analyze query execution and apply incorrect optimization techniques
4.	Result Interpretation and Documentation	10	Clarity in interpreting query outputs, presenting analysis and documenting performance observations	Clarity in interpreting query outputs, presenting analysis but documentation is limited	Poorly interpreting query outputs, presenting analysis or undocumented code
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Database Design and Modeling	5	Ability to design an effective database schema with proper constraints	Ability to design database but not used constraints	Limited understanding of the database design
2.	Implementation of DBMS Features	10	Correct and efficient algorithm with clear logic	Minor errors in logic or implementation	Incorrect logic
3.	Functionality and System Performance	10	Successful implementation of a working database system that meets the defined requirements efficiently.	Successful implementation of a working database system that but not meets the defined requirements	Poor or incomplete implementation
4.	Team Collaboration and Contribution	10	Active participation in team activities, task distribution, and coordination during project development	Moderate participation in team activities, task distribution, and coordination during project development	Poor participation in team activities, task distribution, and coordination during project development

5.	Documentation, Testing, and Presentation	5	Well-documentation and results	Basic documentation	Poor documentation
	Total	40			

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	10	10	10	2
C02	20	20	20	3
C03	20	20	20	3
C04	20	20	20	3
C05	20	10	15	2
C06	10	20	15	2
Total	100	100	100	

26CSC15	PYTHON FOR DATA SCIENCE LABORATORY		SEMESTER				IV	
Prerequisites			Category	ES(PC)	Credits			2
-NIL-			Hours/ Semester	L	T	P	SL	TH
				0	0	45	15	60
COURSE OBJECTIVES								
1.	To develop Python programs using input/output statements, operators, control structures, functions, modules, and string processing techniques for solving computational problems.							
2.	To implement Python data structures, file handling, and exception handling techniques for developing real-world applications and data management systems.							
3.	To perform statistical analysis, correlation analysis, regression, and data preprocessing techniques on real-world datasets for extracting meaningful insights.							
4.	To apply NumPy and Pandas techniques for data manipulation, wrangling, aggregation, and processing of structured datasets efficiently.							
5.	To create effective statistical and graphical visualizations using Matplotlib and Seaborn for analysing and interpreting datasets.							
EXPERIMENTS								
1.	Develop programs using I/O statements and operators.							
2.	Develop programs using decision-making and looping statements							
3.	Develop programs using functions and modules.							
4.	Develop a program for password validation and text analysis using string methods.							
5.	Develop programs using list operations, slicing, copy, clone, and list comprehension for student attendance details.							
6.	Develop programs using tuple, set, and dictionary operations for an inventory management system.							
7.	Develop a program using text/CSV files and exception handling for voter list management.							
8.	Perform data preprocessing, statistical analysis, z-score computation, correlation coefficient analysis, multiple regression, and visualization on the student performance dataset and Sales Forecast Dataset.							
9.	Perform aggregations, comparisons, Boolean masking, fancy indexing, sorting, and array manipulations on the weather dataset using NumPy methods.							
10.	Apply Pandas data wrangling techniques such as indexing, missing data handling, combining datasets, grouping, aggregation, and pivot tables on the student performance dataset.							
11.	Create statistical visualizations using line plots, scatter plots, histograms, subplots, legends, 3D plots, and Seaborn for the stock market dataset.							
Total:60 Hours								
Weightage:								
Continuous Assessment 60%								
End Semester Examinations 40%								

TEXT BOOKS:				
1.	Reema Thareja, "Python Programming using Problem Solving Approach", 3 rd Edition, Oxford University Press, New Delhi, 2020. (Unit I, II)			
2.	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017 (Unit III)			
3.	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016 (Unit IV, V)			
REFERENCE BOOKS:				
1.	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science – Big Data, Machine Learning and more, Using Python Tools", Manning Publications, 2016			
2.	Joel Grus, "Data Science from the Scratch", O'Reilly, 2015			
3.	Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter ", 3rd Edition, O'Reilly Media, 2022.			
4.	Fabio Nelli, "Python Data Analytics: Data Analysis and Science Using Pandas, Matplotlib and the Python Programming Language", 3rd Edition, Apress, 2023.			
5.	Yuli Vasiliev, "Python for Data Science: A Hands-on Introduction", No Starch Press, 2022.			
E-RESOURCES:				
1.	https://www.python.org/			
2.	https://docs.python.org/3/tutorial/datastructures.html			
3.	https://numpy.org/doc/2.4/reference/index.html			
4.	https://www.khanacademy.org/math/statistics-probability			
5.	https://matplotlib.org/stable/tutorials/index.html			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Describe the fundamental concepts, principles, and techniques related to programming, data handling, and data analysis.		-	-
CO2	Apply computational methods and programming constructs to process, manipulate, and analyze structured datasets effectively.		PO1, PO2, PO3, PO5, P11	PSO1, PSO2, PSO3
CO3	Examine datasets using statistical, analytical, and visualization techniques to identify meaningful patterns and relationships.		PO1, PO2, PO3, PO4, PO5, P11	PSO1, PSO2, PSO3
CO4	Formulate suitable data-driven solutions and visual representations to solve real-world computational problems.		PO1, PO2, PO3, PO4, PO5, PO9, P11	PSO1, PSO2, PSO3
CO5	Develop and present individual solutions involving statistical analysis and data visualization to address given computational requirements effectively.		PO1, PO2, PO3, PO4, PO5, PO9, P11	PSO1, PSO2, PSO3

CO6	Collaborate effectively to work as team to apply suitable techniques to any real word dataset and interpret the patterns which helps for effective decision making.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, P11	PSO1, PSO2, PSO3
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The Course Articulation Matrix (CAM) for defined COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	3	-	-	-	-	-	1	3	1	2
CO3	3	3	3	3	3	-	-	-	-	-	1	2	1	3
CO4	3	3	3	3	3	-	-	-	1	-	1	2	2	3
CO5	3	3	3	3	3	-	-	-	3	-	1	3	2	2
CO6	3	3	3	3	3	-	-	3	2	-	1	2	2	3
PAM	3	3	3	3	3	-	-	3	2	-	1	2.4	1.6	2.6

Activities:

1.	Solution development for application-oriented problems using Python and data analysis on real-world datasets.
2.	Implementation of a mini project involving statistical analysis and data visualization using real-world datasets.
3.	Case study / team-based activity for dataset analysis and visualization based on real-world computational problems.

Rubrics or evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem Understanding and Solution Design	2	Clearly understands the problem and develops an effective analytical solution	Understands the problem with Moderate design	Basic understanding and incomplete solution design
2.	Data Preparation and Processing	2	Data is properly cleaned, organized, and processed effectively	Minor issues in data preparation and processing	Incomplete or incorrect data processing
3.	Programming Logic and Implementation	2	Program is logically structured and implemented correctly without errors	Implementation is mostly correct with minor logical or coding issues	Incomplete or incorrect implementation
4.	Statistical Analysis and Visualization	2	Performs accurate analysis and creates meaningful visualizations effectively	Analysis and visualization are mostly correct with minor issues	Incomplete or incorrect analysis and visualization
5.	Presentation and interpretation of results	2	Presents results clearly with proper interpretation and explanation	Presentation is adequate with limited interpretation	Presentation lacks clarity and interpretation
	Total	10			

Rubricsforevaluation:CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
1.	Problem understanding and solution approach	3	Clearly understands the problem and proposes an effective solution approach	Understands the problem with minor issues in approach	Limited understanding of the problem
2.	Technical contribution and implementation	3	Correctly implements the required concepts and provides accurate analysis/results	Implements concepts with minor errors in analysis or results	Incomplete or incorrect implementation and analysis
3.	Team participation, communication, and presentation	2	Actively contributes, communicates effectively, and presents ideas/results clearly with strong teamwork	Participates and communicates adequately with minor issues in presentation or collaboration	Limited participation, communication, or presentation skills
4.	Documentation and report submission	2	Complete results and explanations	Lacks some explanations of the results	Incomplete results
	Total	10			

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

CO	Evaluation of Student Work, Observation of Record and Model Test	Activities	Percentage allocation	Mapping Strength
CO1	10	10	10	1
CO2	20	10	15	3
CO3	20	20	20	3
CO4	20	20	20	2
CO5	20	20	20	2
CO6	10	20	15	1
Total	100	100	100	

26MCC02	ENVIRONMENTAL SCIENCE AND ENGINEERING			SEMESTER			IV	
Prerequisites			Category	MC	Credits			3
Nil			Hours/ Semester	L	T	P	SL	TH
				45	0	0	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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	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	Good	Satisfactory
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 health, safety, community welfare	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: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
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: CO6

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
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 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: 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
COURSE OBJECTIVES								
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 standard 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, PanchayatiRaj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake- holders – Institutional Processes and Framework 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, programmers and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment								
UNIT - IV		DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES & FIELD WORKS						6
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: 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 field works 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%				
REFERENCE BOOKS:				
1.	Disaster Management: Risk. Response. Recovery. By Dr.RajLaxmi Dr.AmitSinha(2025)			
2	Disaster Management by Shaikh Ubaid (Author)" 2020. First Edition Technical Publications.			
3.	Disaster Management" AUTHOR: K.SriramKumar, P.KrishnaSankar, S.Arunprasath - PUBLICATION: ARS			
4.	Govt. of India: Disaster Management Act, Government of India, New Delhi, 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: NIDMYouTubeChannel			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to				
CO1	Explain the concepts of disasters, hazards, vulnerability, resilience, risk, and their impacts on society, economy, environment, and public health.	Mapping POs	Mapping PSOs	
CO2	Apply disaster risk reduction (DRR) principles, disaster cycle concepts, and community- based approaches for disaster preparedness and mitigation.	PO2, PO6	PSO1	
CO3	Analyzed is as 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.	Activity1 (CO5): Case Study / Field Work Flood Risk Assessment Landslide Hazard Mapping Cyclone Impact Assessment Forest Fire Analysis Disaster Relief Camp Evaluation
2.	Activity2 (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 for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
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 for evaluation: C06

Sl. No.	Criterion	Marks	Excellent	Good	Satisfactory
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
C01	12	12			6	1
C02	24	24			47	3
C03	12	12			16	2
C04	12	12			11	2
C05			40		10	2
C06				40	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%);

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			