



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. Mechanical Engineering (Full Time)

Regulations: 2026

Overview of Credits

Sem	BS	HM	ES(G)	ES(PC)	ES(PE)	OE	SD	MC	Total
I	7	3	12						22
II	12	3	4				2		21
III	3			20				3	26
IV		2		19			1	3	25
V				17	3		1		21
VI				7	9	3	3		22
VII		3		12	6				21
VIII							10		10
Total	22	11	16	75	18	3	17	6	168
% of Category	13.10	6.55	9.52	44.64	10.71	1.79	10.12	3.57	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.	26ENC02	Professional English	LIT	30	0	15	15	60	2	HM	50	50	100
3.	26ME101	Applied Mechanics	T	45	15	0	60	120	4	ES(G)	40	60	100
4.	26PHC02	Materials Science	T	45	0	0	45	90	3	BS	40	60	100
5.	26MEC01	Engineering Graphics	T	30	45	0	45	120	4	ES(G)	40	60	100
6.	26EEC01	Basic Electrical and Electronics Engineering	LIT	45	0	45	30	120	4	ES(G)	50	50	100
7.	26HMC01	Heritage of Tamils / தமிழர் மரபு	T	15	0	0	15	30	1	HM	40	60	100
8.	26MCC01	Induction Programme	T	-	-	-	-	-	0	MC	-	-	-
Total								660	22				

Semester II													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26MAC02	Ordinary Differential Equations and Transform Techniques	T	45	15	0	60	120	4	BS	40	60	100
2.	26ENC01	Communicative English	T	45	0	0	15	60	2	HM	40	60	100
3.	26CYC01	Applied Chemistry	LIT	45	0	45	30	120	4	BS	50	50	100
4.	26PHC01	Applied Physics	LIT	45	0	45	30	120	4	BS	50	50	100
5.	26HMC02	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	T	15	0	0	15	30	1	HM	40	60	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.	26MCS01	Engineering Sprints	L	0	0	15	15	30	0	SD	100	-	100
9.	26NCC01	NCC Course - I*	T	30	0	0	30	60	2*	-	40	60	100
Total								720	21				

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

Semester III													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26MAC04	Partial Differential Equations and Complex Variables	T	45	15	0	30	90	3	BS	40	60	100
2.	26ME301	Engineering Thermodynamics	T	45	15	0	60	120	4	ES(PC)	40	60	100
3.	26ME302	Fluid Mechanics and Machinery	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26ME303	Materials Engineering	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
5.	26ME304	Manufacturing Technology	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
6.	26ME305	Mechanics of Materials	T	45	0	0	45	90	3	ES(PC)	40	60	100
7.	26CE306	Strength of Materials and Fluid Mechanics 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.	26MCS02	Innovation Sprints	L	0	0	15	15	30	0	SD	100	-	100
10.	26NCC02	NCC Course – II *	T	30	0	0	30	60	2*	-	40	60	100
Total								870	26				

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

Semester IV													
Sl. No.	Course Code	Course Name	Course Type	Hours per Semester					Credits	Category	Weightage		
				L	T	P	SL	TH			CA %	ES %	Total
1.	26ME401	Theory of Machines	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
2.	26ME402	Thermal Engineering	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
3.	26ME403	Metal cutting and Machine Tools	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
4.	26ME404	Solar and Wind Energy	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26ME405	Machine Drawing	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
6.	26ENC03	Placement and Soft Skills Laboratory	L	0	0	45	15	60	2	HM	60	40	100
7.	26MCC03	Universal Human Values	T	45	0	0	45	90	3	MC	40	60	100
8.	26MEICXX	Industry Oriented Course - I	IOC	15	0	0	15	30	1	SD	100	-	100
9.	26MCS03	Design Sprints	L	0	0	15	15	30	0	SD	100	-	100
Total								780	25				

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.	26ME501	Design of Machine and Power Transmission Elements	T	45	15	0	60	120	4	ES(PC)	40	60	100
2.	26ME502	Heat and Mass Transfer	T	45	15	0	60	120	4	ES(PC)	40	60	100
3.	26ME503	Industrial Engineering and Management	T	45	0	0	45	90	3	ES(PC)	40	60	100
4.	26ME504	Metrology and Quality Control	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
5.	26MEPEXX	Programme Elective - I	T	45	0	0	45	90	3	ES(PE)	40	60	100
6.	26ME505	Heat Transfer Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
7.	26MEICXX	Industry Oriented Course - II	IOC	15	0	0	15	30	1	SD	100	-	100
8.	26MCC04	Disaster Management and Preparedness	T	30	0	0	30	60	0	MC	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								780	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.	26MED01	Capstone Design Project Level-I	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26MEHXX	Honours Elective - I	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26MEHXX	Honours Elective - II	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26MEMXX	Minor Elective - I	T	45	0	0	45	90	3	OE	40	60	100
2.	26MEMXX	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.	26ME601	Hydraulics and Pneumatics	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
2.	26ME602	Smart Manufacturing	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26MEPEXX	Programme Elective - II	T	45	0	0	45	90	3	ES(PE)	40	60	100
4.	26MEPEXX	Programme Elective - III	T	45	0	0	45	90	3	ES(PE)	40	60	100
5.	26MEPEXX	Programme Elective - IV	T	45	0	0	45	90	3	ES(PE)	40	60	100
6.	26MEOE0X	Open Elective - I	T	45	0	0	45	90	3	OE	40	60	100
7.	26ME603	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.	26MED02	Capstone Design Project Level-II	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26MEHXX	Honours Elective - III	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26MEHXX	Honours Elective - IV	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26MEMXX	Minor Elective - III	T	45	0	0	45	90	3	OE	40	60	100
2.	26MEMXX	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.	26HSC01	Operations Research	T	45	0	0	45	90	3	HM	40	60	100
2.	26ME701	Finite Element Analysis	T	45	0	0	45	90	3	ES(PC)	40	60	100
3.	26ME702	Automobile Technology	LIT	45	0	45	30	120	4	ES(PC)	50	50	100
4.	26ME703	Total Quality Management	T	45	0	0	45	90	3	ES(PC)	40	60	100
5.	26MEPEXX	Programme Elective - V	T	45	0	0	45	90	3	ES(PE)	40	60	100
6.	26MEPEXX	Programme Elective - VI	T	45	0	0	45	90	3	ES(PE)	40	60	100
7.	26ME705	Simulation Laboratory	L	0	0	45	15	60	2	ES(PC)	60	40	100
Total								630	21				

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.	26MED03	Capstone Design Project Level-III	CDP	0	0	90	90	180	6	SD	60	40	100
OR													
1.	26MEHXX	Honours Elective - V	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26MEHXX	Honours Elective - VI	T	45	0	0	45	90	3	ES(PE)	40	60	100
For Minor Degree													
1.	26MEMXX	Minor Elective - V	T	45	0	0	45	90	3	OE	40	60	100
2.	26MEMXX	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.	26ME801	Project Work	PW	0	0	225	75	300	10	SD	60	40	100
Total								300	10				
Total Credits of the Programmes									168				

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.	26MEPE01	Advanced Strength of Materials	T	45	0	0	45	90	3	ES(PE)	40	60	100
2.	26MEPE02	Renewable Energy Systems	T	45	0	0	45	90	3	ES(PE)	40	60	100
3.	26MEPE03	Advanced I.C Engine Technologies	T	45	0	0	45	90	3	ES(PE)	40	60	100
4.	26MEPE04	Composite Materials	T	45	0	0	45	90	3	ES(PE)	40	60	100
5.	26MEPE05	Applications of IoT & IIoT in Mechanical Engineering	T	45	0	0	45	90	3	ES(PE)	40	60	100
Programme Elective - II													
6.	26MEPE06	Tribology in Design	T	45	0	0	45	90	3	ES(PE)	40	60	100
7.	26MEPE07	Energy Efficient Buildings Design	T	45	0	0	45	90	3	ES(PE)	40	60	100
8.	26MEPE08	Refrigeration & HVAC Systems	T	45	0	0	45	90	3	ES(PE)	40	60	100
9.	26MEPE09	Mechatronics	T	45	0	0	45	90	3	ES(PE)	40	60	100
10.	26MEPE10	AIML	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.	26MEPE11	Design of Production Tooling and Press Tools	T	45	0	0	45	90	3	ES(PE)	40	60	100
13.	26MEPE12	Power Plant Engineering	T	45	0	0	45	90	3	ES(PE)	40	60	100
14.	26MEPE13	Cryogenic Engineering	T	45	0	0	45	90	3	ES(PE)	40	60	100
15.	26MEPE14	Non-Traditional Machining Process	T	45	0	0	45	90	3	ES(PE)	40	60	100
16.	26MEPE15	Computer Integrated Manufacturing	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.	26MEPE16	Digital Twin	T	45	0	0	45	90	3	ES(PE)	40	60	100
19.	26MEPE17	Electric Vehicle Fuel Cell Technology	T	45	0	0	45	90	3	ES(PE)	40	60	100
20.	26MEPE18	Gas Dynamics and Jet Propulsion	T	45	0	0	45	90	3	ES(PE)	40	60	100
21.	26MEPE19	Design for Manufacturing and Assembly	T	45	0	0	45	90	3	ES(PE)	40	60	100
22.	26MEPE20	Engineering System Modelling and Simulation	T	45	0	0	45	90	3	ES(PE)	40	60	100
Programme Elective - V													
23.	26MEPE21	Integrated Product Design and Development	T	45	0	0	45	90	3	ES(PE)	40	60	100
24.	26MEPE22	Instrumentation in Thermal Engineering	T	45	0	0	45	90	3	ES(PE)	40	60	100
25.	26MEPE23	Heat Transfer in Electronics and Instrumentation	T	45	0	0	45	90	3	ES(PE)	40	60	100
26.	26MEPE24	Mechanical Behaviour of Materials and Characterization	T	45	0	0	45	90	3	ES(PE)	40	60	100
27.	26MEPE25	Python Programming	T	45	0	0	45	90	3	ES(PE)	40	60	100

Programme Elective - VI													
28.	26MEPE26	Supply Chain Management	T	45	0	0	45	90	3	ES(PE)	40	60	100
29.	26MEPE27	Professional Ethics and Human Values	T	45	0	0	45	90	3	ES(PE)	40	60	100
30.	26MEPE28	Entrepreneurship Development	T	45	0	0	45	90	3	ES(PE)	40	60	100
31.	26MEPE29	Product Planning and Cost Control	T	45	0	0	45	90	3	ES(PE)	40	60	100
32.	26MEPE30	Industrial Safety	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
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

List of Honours Courses

Sl. No.	Course Code	Course Name
1.	26MEH01	Electric and Hybrid Vehicle Technology
2.	26MEH02	Advanced Energy Storage Technologies
3.	26MEH03	Design of Solar and Wind Systems
4.	26MEH04	Smart Materials and Structures
5.	26MEH05	Mechanical Vibrations
6.	26MEH06	Advanced Materials Technology
7.	26MEH07	Additive Manufacturing
8.	26MEH08	Non Destructive Testing and Failure Analysis
9.	26MEH09	Industrial Layout Design and Safety
10.	26MEH10	Digital Manufacturing and IOT

26MAC01	MATRICES AND CALCULUS B.E. (Common to all Branches Except EEE)		SEMESTER				I
Prerequisites		Category	BS	Credits			4
Basic 12th level Matrices, Differential Calculus and Integral Calculus.		Hours/ Semester	L	T	P	SL	TH
			45	15	0	60	120
COURSE OBJECTIVES							
1.	To understand the fundamental concepts of matrices, eigen values, eigen vectors, diagonalization and quadratic forms for solving algebraic and engineering problems.						
2.	To develop knowledge in functions of several variables, partial differentiation, Jacobians, and optimization techniques involving maxima, minima and Lagrange multipliers.						
3.	To apply techniques of integral calculus, including differentiation under the integral sign, Leibnitz rule, and Beta and Gamma functions in the evaluation of integrals.						
4.	To acquire problem-solving skills in double and triple integrals, change of variables and applications related to area and volume computations.						
5.	To understand and apply vector calculus concepts such as gradient, divergence, curl, line, surface, and volume integrals along with Green's, Stoke's and Gauss divergence theorems in mathematical and engineering applications.						
UNIT - I	MATRICES						12
Eigenvalues and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley–Hamilton theorem excluding proof – Diagonalization of matrices – Reduction of quadratic forms to canonical form using orthogonal transformation – Nature of quadratic forms.							
UNIT - II	FUNCTIONS OF SEVERAL VARIABLES						12
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 undetermined multipliers.							
UNIT - III	INTEGRAL CALCULUS						12
Differentiation under integrals – Evaluation of integrals involving parameters by Leibniz rule – Beta and Gamma functions – Properties of Beta and Gamma functions – Evaluation of single integrals using Beta and Gamma functions.							
UNIT - IV	MULTIPLE INTEGRALS						12
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						12
Gradient of a scalar field – Directional derivative – Divergence and curl – Solenoidal and irrotational vector fields – Line integrals over plane curves – Surface integrals – Area of curved surfaces – Volume integrals – Green's theorem, Stokes' theorem and Gauss divergence theorem without proof – 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%

REFERENCE BOOKS:

1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, New Delhi, 2020.
2.	Joel Hass, Christopher Heil, Maurice D.Weir, "Thomas' Calculus", 14th Edition, Pearson Education, New Delhi, 2018.
3.	James Stewart, Daniel K Clegg & Saleem Watson, "Calculus with Early Transcendental Functions", Cengage Learning, 6th Edition, New Delhi, 2023.
4.	Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Pvt Ltd., New Delhi, 2018.
5.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017.

E-RESOURCES:

1.	NPTEL, "Engineering Mathematics-I", National Programme on Technology Enhanced Learning, https://www.nptel.ac.in/courses/111105121
2.	MIT OpenCourseWare, "Single Variable Calculus and Multivariable Calculus", Massachusetts Institute of Technology, https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/
3.	Khan Academy, "Linear Algebra and Multivariable Calculus", https://www.khanacademy.org/math/linear-algebra , https://www.khanacademy.org/math/multivariable-calculus
4.	Paul's Online Math Notes, "Calculus III and Linear Algebra", Lamar University, https://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx
5.	Wolfram MathWorld, "Mathematics Resource", Wolfram Research, https://mathworld.wolfram.com/topics/VectorCalculus.html

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

CO1	Remember and understand the fundamental concepts and methods in matrices, functions of several variables, integral calculus, multiple integrals and vector calculus including eigen values and eigen vectors, Cayley–Hamilton theorem, quadratic forms, partial derivatives, Jacobians, maxima and minima, Beta and Gamma functions, double and triple integrals, gradient, divergence, curl and Green's, Stoke's and Gauss divergence theorems.	-	-
CO2	Apply the concepts and techniques of matrices, functions of several variables, integral calculus, multiple integrals and vector calculus to solve mathematical and engineering problems involving eigen values and quadratic forms, optimization of multivariable functions, evaluation of integrals using Beta and Gamma functions, computation of areas and volumes through multiple integrals and evaluation of line, surface, and volume integrals using Green's, Stoke's and Gauss divergence theorems.	PO1	PSO1

C03	Analyze mathematical and engineering problems using the principles of matrices, functions of several variables, integral calculus, multiple integrals and vector calculus by interpreting eigen values and quadratic forms, examining extrema of multivariable functions, selecting suitable integration techniques, transforming multiple integrals using coordinate changes and analyzing vector fields through divergence, curl and integral theorems.	PO2	PSO1
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	PSO2
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

	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
C01	-	-	-	-	-	-	-	-	-	-		-	-	-
C02	2	-	-	-	-	-	-	-	-	-	-	2	-	-
C03	-	2	-	-	-	-	-	-	-	-	-	2	-	-
C04	-	-	1	-	-	-	-	-	-	-	-	-	2	-
C05	-	-	-	-	-	-	-	-	-	3	-	-	2	-
C06	-	-	-	-	3	-	-	-	-	-	-	-	2	-

Activities:

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

Rubrics for evaluation: C05

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

Rubrics for evaluation: C06

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

4.	Report preparation and conclusion	8	Report has objective, procedure, output, interpretation and conclusion	Report is acceptable, but needs better structure or explanation	Report is incomplete or poorly structured
5.	Overall presentation and analytical quality	8	Work demonstrates excellent analytical approach and professional presentation	Analytical quality and presentation are good with minor issues	Analytical quality is satisfactory but lacks depth
	Total	40			

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

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

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

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

UNIT - IV	ORGANIZING EVENTS	9	
Listening: Working in an international team, Statistical information, Interview with investor relations. Reading: Company profiles, Statement of Purpose (SOP), An excerpt of interview with professionals. Speaking: Proposing welcome address, vote of thanks and organizing events. Writing: Letter Writing – Formal Letters and Informal Letters, Job Application, Cover letter with resume. Grammar: Reported speech, Question tags, Simple, Compound and Complex sentences.			
UNIT - V	PROCESS DESCRIPTION	9	
Writing effective titles, abstracts, introductions and conclusions. Presenting findings and discussions clearly. Language for oral presentation of research. Useful phrase banks for different sections of a research paper and research presentations.			
L:30, P:15, SL:15, Total:60 Hours			
Weightage: Continuous Assessment 50% End Semester Examinations 50%			
REFERENCE BOOKS:			
1.	Beare, Kenneth. Reading Skills Success in 20 Minutes a Day. 4th ed., LearningExpress, 2017.		
2.	Hewings, Martin. Advanced English Grammar. 3rd ed., Cambridge University Press, 2019.		
3.	Koneru, Aruna. English Language Skills for Engineers. McGraw Hill Education, 2020.		
4.	Murphy, Raymond. English Grammar in Use. 5th ed., Cambridge University Press, 2019.		
5.	Guffey, Mary Ellen, and Dana Loewy. Essentials of Business Communication. 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			
CO1	Demonstrate effective listening, reading, speaking, and writing (LSRW) skills in academic and professional communication contexts.	PO9, PO11	-
CO2	Apply appropriate grammar, vocabulary, pronunciation, and language conventions to ensure accurate, fluent, and effective communication across various contexts.	PO9, PO11	-
CO3	Deliver oral presentations, speeches, and self-introductions confidently using suitable verbal and non-verbal communication strategies.	PO9, PO11	PSO1
CO4	Analyze and interpret different forms of written texts such as stories, poems, newspaper articles, company profiles, advertisements, and technical documents.	PO9, PO11	PSO2

C05	Develop professional writing skills for drafting reviews, essays, news articles, minutes of meetings, letters, resumes, cover letters, process descriptions, and advertisements.	PO9, PO10	PSO3
C06	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

	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
C01	-	-	-	-	-	-	-	-	3	-	2	-	-	-
C02	-	-	-	-	-	-	-	-	3	-	2	-	-	-
C03	-	-	-	-	-	-	-	-	3	-	2	1	-	-
C04	-	-	-	-	-	-	-	-	3	-	2	-	1	-
C05	-	-	-	-	-	-	-	-	3	2		-	-	2
C06	-	-	-	-	-	-	-	2	3		2	-	-	2

Activities:

1.	C05: Develop professional writing skills for drafting reviews, essays, news articles, minutes of meetings, letters, resumes, cover letters, process descriptions, and advertisements. (i) Review Writing Activity: Write a critical review of a favorite book, movie, gadget, or product by analyzing its features, strengths, weaknesses, and overall impact on the audience. (ii) News Article and Meeting Minutes Preparation: Attend a mock event, seminar, club activity, or classroom discussion and prepare a news article and formal minutes of the meeting following standard format. (iii) Professional Correspondence Portfolio: Prepare a portfolio consisting of formal letters, informal letters, job application letters, resumes, and cover letters for different academic and professional scenarios. (iv) Process Description: Develop a step-by-step process description for technical and administrative activities such as online registration, booking a meeting hall, purchasing equipment, printing documents, or conducting an event. (v) Advertisement and Creative Writing Project: Design print or digital advertisements for products, services, technical events, or social awareness campaigns highlighting their purpose and target audience.
	C06: 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.

2.	(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.

Rubrics for evaluation: C05

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

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Presentation Skills	10	Highly confident, clear articulation, excellent eye contact, and engaging delivery	Clear and confident with minor issues in delivery	Adequate presentation with some hesitation
2.	Communication Effectiveness	10	Excellent verbal & non-verbal communication; ideas conveyed clearly and persuasively	Good communication with minor gaps	Understandable communication but lacks impact

3.	Interpersonal Skills and Teamwork	10	Excellent collaboration, leadership, and positive interaction with team members	Good teamwork and cooperative behavior	Works with team but limited engagement
4.	Event/Activity Organization Skills	10	Excellent planning, coordination, and execution of tasks/events	Good organization with minor gaps in execution	Basic organization with limited efficiency
	Total	40			

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

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

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

26ME101	APPLIED MECHANICS		SEMESTER				I
Prerequisites		Category	ES(G)	Credits			4
Basic Engineering Mathematics and Physics		Hours/ Semester	L	T	P	SL	TH
			45	15	0	60	120
COURSE OBJECTIVES							
1.	Apply principles of equilibrium to analyse rigid body systems in 2D space.						
2.	Calculate geometry-dependent properties such as centroid and moments of inertia.						
3.	Analyse frictional effects in engineering applications.						
4.	Understand the kinematics and kinetics of rigid bodies in plane motion.						
5.	Develop problem solving skills in engineering mechanics using analytical methods.						
UNIT - I STATICS OF RIGID BODIES							
12							
Resolution of a Force into Components, Free body diagram. Equivalent systems of forces acting on a rigid body in 2D space: Principle of transmissibility – Moment of force about a point – Varignon’s theorem – Moment of a couple – Equivalent couple – Moment of force about an axis – Coplanar non-concurrent forces acting on rigid bodies – Resultant and equilibrium – Resolution of a given force into force couple system – Equilibrium of rigid bodies in 2D space – Reactions and supports.							
UNIT - II GEOMETRY DEPENDENT PROPERTIES							
12							
Centre of gravity, Centre of mass and Centroid – Moment of Inertia of simple and complex areas – Transfer formula – Radius of gyration – Polar moment of inertia – Product of inertia - Mass moment of Inertia of simple solids, thin plates, composite bodies.							
UNIT - III FRICTION							
12							
Laws of friction – coefficient of friction – Dry friction – wedge friction – ladder friction – rolling resistance. Applications of friction by analytical approach in belt drives – open belt drive, clutches – plate and cone clutches, Brakes – single shoe brake.							
UNIT - IV KINEMATICS OF RIGID BODIES – PLANE MOTION							
12							
Kinematics of rigid bodies: Plane motion, translation and rotation. General plane motion: Absolute velocity, relative velocity, instantaneous centre of rotation, absolute acceleration, relative acceleration.							
UNIT - V KINETICS OF RIGID BODIES – PLANE MOTION							
12							
Equations of motion of a rigid body - angular momentum, D’Alembert’s principle; Principle of work and energy for a rigid body, work of forces acting on a rigid body, kinetic energy of a rigid body in plane motion, conservation of energy; Impulse-momentum principle for the plane motion of a rigid body; Overview of Lagrange’s equations of motion							
L:45, T:15, SL:60, Total:120 Hours							
Weightage:							
Continuous Assessment 40%							
End Semester Examinations 60%							

REFERENCE BOOKS:			
1.	Beer, Ferdinand P., E. Russell Johnston, David Mazurek, Phillip Cornwell, and Brian Self. Vector Mechanics for Engineers: Statics and Dynamics. Tata McGraw-Hill, 2024.		
2.	James L. Meriam, L. G. Kraige, J. N. Bolton: Engineering Mechanics Statics, 9th Edition, Wiley Student Edition, 2020.		
3.	James L. Meriam, L. G. Kraige, J. N. Bolton: Engineering Mechanics Dynamics, 9th Edition, Wiley Student Edition, 2020.		
4.	P. Boresi and J. Schmidt, "Engineering Mechanics: Statics and Dynamics", Cengage Learning, 2008.		
5.	Irving H. Shames and G. Krishna Mohana Rao, "Engineering Mechanics – Statics and Dynamics", PHI Learning, 2006.		
E-RESOURCES:			
1.	NPTEL Engineering Mechanics Courses.		
2.	MIT OpenCourseWare – Engineering Mechanics.		
3.	Online simulation tools for Mechanics.		
4.	IIT Virtual Labs – Mechanics.		
5.	e-ShodhSindhu and DELNET Digital Resources.		
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 of forces, equilibrium, centroid, moment of inertia, friction and rigid body mechanics in engineering applications.	-	-
CO2	Apply principles of statics, centroid and moment of inertia to solve engineering mechanics problems involving rigid bodies and structures.	PO1, PO2	PSO1
CO3	Analyze engineering systems involving friction, kinematics and kinetics of rigid bodies under various loading and motion conditions.	PO2, PO3	PSO2
CO4	Evaluate motion characteristics, energy principles and dynamic behavior of rigid bodies using analytical approaches.	PO2, PO3	PSO2
CO5	Analyze and interpret engineering mechanics problems using numerical and analytical methods for practical engineering applications.	PO2, PO5	PSO2
CO6	Study real-world engineering mechanics applications through self-learning activities and communicate findings considering societal and engineering impacts.	PO6, PO9, PO11	PSO3

The Course Articulation Matrix (CAM) for defined Cos

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

Activities:

1.	Problem solving using analytical tools and numerical applications (CO5).
2.	Technical seminar / Case study on engineering mechanics applications (CO6).

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Problem formulation	8	Problem clearly defined with proper assumptions	Problem defined with minor issues	Problem statement unclear
2.	Analytical procedure	12	Correct and systematic solution procedure	Minor mistakes in procedure	Incomplete procedure
3.	Interpretation of results	12	Results are clearly interpreted & justified	Limited interpretation	Incorrect interpretation
4.	Report presentation	8	Well-structured and neat presentation	Average presentation	Poor presentation
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Understanding torsional behavior	10	Clearly explains engineering application	Explanation adequate	Limited understanding

2.	Safety & Economic considerations	10	Clearly discusses impacts and applications	Partially discussed	Poorly explained
3.	Evidence of self-learning	10	Uses journals, online resources and references effectively	Limited references used	Very few references used
4.	Presentation & Communication	10	Presentation is clear and well-structured	Needs improvement	Poorly structured presentation
	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		
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%);

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

UNIT - V	ADVANCED ENGINEERING MATERIALS	9	
Metallic Glasses: Preparation – Properties – Applications. Shape Memory Alloys (SMA): Types – Properties – Applications. Ceramic Materials: Classification – Properties – Traditional and advanced ceramics – Applications. Composite Materials: Classification – Fiber 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%			
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. Ownen, '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			
CO1	Explain the preparation, properties and applications of various materials.	Mapping POs	Mapping PSOs
CO2	Apply the principles of various materials to identify suitable materials for diverse applications.	PO1	
CO3	Analyse the properties and performance of different materials suitable for specific applications.	PO2	
CO4	Perform experimentations as a group and interpret the results.	PO4, PO8	
CO5	Communicate the societal, environmental and technological impacts of engineering materials in solving real-world problems.	PO6, PO9	
CO6	Analyse emerging engineering materials to address modern industrial and societal needs in engineering applications through self-learning activities	PO11	

The Course Articulation Matrix (CAM) for defined Cos

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

Activities:

1.	a. Experimental determination of Hall coefficient / Hysteresis loop for a ferromagnetic material b. Seminar / Poster presentation on dielectric materials in renewable energy systems / Economic, Environmental and Social issues of material usage
2.	a. Literature review on nanomaterial product for real-world problems b. Product analysis of advanced materials used in engineering applications

Rubrics for evaluation: CO4

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Formula / Theory	10	Clearly explains the concept with correct formula	Explains the concept with minor errors	Limited understanding of theory and formula
2.	Procedure & Observation	10	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	30			

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Subject Knowledge	5	Clearly explains the concept with relevant examples	Good explanation with minor gaps	Basic understanding of the topic

2.	Content Organization	5	Information is well-organized, clear, and logically presented	Organization is good with minor improvements needed	Average organization of content
3.	Poster / Presentation Design	5	Attractive, creative, and easy-to-understand design with effective visuals	Good design with minor issues	Adequate design with limited visuals
4.	Communication Skills	5	Confident presentation with clear explanation and effective response to questions	Good communication with slight hesitation	Basic communication skills
	Total	20			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (4)	Good (3)	Satisfactory (2)
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			

Rubrics for evaluation: CO3

Sl. No.	Criterion	Marks	Excellent (4)	Good (3)	Satisfactory (2)
1.	Understanding the concept	10	Clearly explains the concept with relevant examples	Explains the topic with minor gaps	Limited understanding of advanced materials

2.	Product Analysis	10	Effectively analyzes material performance, advantages, limitations, and engineering applications	Analysis is adequate with minor shortcomings	Basic or incomplete analysis
3.	Presentation & Communication	10	Information is well-organized and communicated clearly with proper visuals/references	Presentation is good with minor improvements needed	Poor organization and unclear communication
	Total	30			

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

CO	Test I	Test II	Activity I	Activity II	Percentage allocation	Mapping Strength
CO1	20	20	-	-	20	-
CO2	22	22	-	-	22	3
CO3	18	18	-	20	28	3
CO4	-	-	20	-	10	2
CO5	-	-	20	-	10	2
CO6	-	-	-	20	10	2
Total	60	60	40	40	100	

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

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

Weightage:

Continuous Assessment 40%

End Semester Examinations 60%

REFERENCE BOOKS:

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

E-RESOURCES:

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

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

The Course Articulation Matrix (CAM) for defined COs

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

Activities:

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

Rubrics for evaluation: CO5

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

Rubrics for evaluation: CO6

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

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

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

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

26EEEC01	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING		SEMESTER				I
Prerequisites		Category	ES(G)	Credits			4
Physics		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 18							
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 18							
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 18							
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	18
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	18
Structure of Electrical Power Systems: Generation, Transmission, and Distribution – Earthing and Methods of Earthing – Protective Devices: SFU, MCB, MCCB, and ELCB. Functional Elements of Measuring Instruments – Construction and Working Principle of Moving-Coil and Moving-Iron Instruments. Practical: Demonstration of House wiring, Stair-case wiring and Fluorescent lamp wiring. Study of basic electrical safety precautions and use of measuring instruments such as voltmeter, ammeter and multimeter. Activities: Physical demonstration of House Wiring tools and components. Physical Demonstration of Types of House Wiring. Physical demonstration of Types of Wires and Cables.		
L:45, P:45, SL:30, Total:120 Hours		
Weightage: Continuous Assessment 50% End Semester Examinations 50%		
TEXT BOOKS:		
1.	Kothari, D. P., and Nagrath, I. J., "Basic Electrical Engineering", Tata McGraw Hill, 2010.	
2.	Muthu Subramaniam. R., Salivaganan. R., and Muralidharan. K. A., "Basic Electrical and Electronics Engineering", Second Edition, Tata McGraw Hill, 2010.	
3.	Kulshreshtha. D.C., "Basic Electrical Engineering", Tata McGraw Hill, 2009.	
4.	Theraja, B. L., and Theraja, A. K., "A Textbook of Electrical Technology, Vol. I: Basic Electrical Engineering", S. Chand Publishing, 2014.	
REFERENCE BOOKS:		
1.	Mehta. V. K., and Mehta, Rohit, "Principles of Electrical Engineering", S. Chand Publications, 2008.	
2.	Hughes. E., "Electrical and Electronics Technology", Pearson, 2010.	
3.	Bobrow. L. S., "Fundamentals of Electrical Engineering", Oxford University Press, 2011.	

E-RESOURCES:														
1.	https://nptel.ac.in/courses/117106108													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to											Mapping POs		Mapping PSOs	
CO1	Analyze the basic DC and AC electric circuits.										PO2			
CO2	Apply electromagnetic principles to interpret the working of electrical machines and transformers.										PO1			
CO3	Analyze the operation and characteristics of electronic devices.										PO2			
CO4	Choose appropriate protective devices, earthing and measuring instruments in power system for safe electrical installation.										PO5, PO11			
CO5	Apply knowledge of fundamental laws and theorems for solving problems in DC and AC electric circuits.										PO1, PO3, PO11			
CO6	Make an effective technical seminar presentation as a Team: Measuring instruments, sensors and transducers, Types of House wiring, Types of wires and Cable, DC and AC motor starters.										PO8, PO9, PO11			
The Course Articulation Matrix (CAM) for defined Cos														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 01	PSO 02	PSO 03
CO1		3												
CO2	3													
CO3		3												
CO4					3						2			
CO5	3		3								2			
CO6								3	3		2			
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

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)

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		
C01	40				40	40	30	3
C02	20	20			30	30	25	2
C03		20			10	10	10	2
C04		20			20	20	15	2
C05			40				10	2
C06				40			10	2
Total	60	60	40	40	100	100	100	

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

26HMC01		தமிழர் மரபு B.E. - அனைத்து துறைகளுக்கும் பொதுவானது		பருவம்		I		
முன்தேவைகள்			Category	HM	Credits		1	
இலக்கணம் மற்றும் இலக்கியத்தின் அடிப்படைகள்			Hours/ Semester	L	T	P	SL	TH
				15	0	0	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 விகிதம்:

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.	பொருநரை- 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
C01	-	-	-	-	-	-	-	-	2	-	-	-	-	-
C02	2	-	-	-	-	-	-	-	2	-	-	2	-	-
C03	-	-	-	-	-	-	-	-	2	-	-	-	-	-
C04	-	1	-	-	-	-	-	-	1	-	-	-	-	-
C05	-	-	-	-	-	-	-	-	2	2	-	-	-	2
C06	-	-	-	-	-	-	-	2	2	2	-	-	-	2

Activities:

1.	C05: 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.	C06: 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 நிறைவேற்றப்பட்டதாகவும்கூட 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, துல்லியமானதாகவும் , 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
Flora and Fauna of Tamils, Aham and Puram Concepts from <i>Tholkappiyam</i> and Sangam Literature Aram Concept of Tamils, Education and Literacy during the Sangam Age. Ancient Cities and Ports of the Sangam Age, Export and Import during the Sangam Age Overseas Conquests of the Cholas.								
UNIT - V		CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE						3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.								
L:15, SL:15, Total:30 Hours								

Weightage: Continuous Assessment: 40% End Semester Examinations: 60%														
REFERENCE BOOKS:														
1.	Dr. K. K. Pillay., "Social Life of Tamils" A joint publication of TNTB & ESC and RMRL – (in print)													
2.	Dr. S. Singaravelu., "Social Life of the Tamils - The Classical Period", International Institute of Tamil Studies Publications.													
3.	"Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Publications, Tamil Nadu.													
4.	"Keeladi-Sangam City Civilization on the banks of river Vaigai", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Publications, Tamil Nadu.													
E-RESOURCES:														
1.	https://en.wikipedia.org/wiki/Dravidian_languages													
2.	https://www.tamilvu.org/courses/degree/													
3.	https://www.scribd.com/document/802136891/Heritage-of-Tamils													
4.	https://www.scribd.com/document/718189396/AKAM-AND-PURAM													
5.	https://pmc.ncbi.nlm.nih.gov/articles/PMC10357311/													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to										Mapping POs		Mapping PSOs		
CO1	Acquire knowledge of Tamil language, literature, and the Thinaï concepts that reflect the cultural and ecological wisdom of the Tamils.									PO9		-		
CO2	Familiarize with the artistic heritage of the Tamils through the study of painting, sculpture, folk traditions, and martial arts.									PO1, 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.									PO2, PO9				
CO5	Examine the traditional scientific knowledge, technological achievements, and cultural heritage of the Tamils, and understand their historical and contemporary significance.									PO9, PO10		PSO3		
CO6	Demonstrate the applications and relevance of Tamil scientific, technological, and cultural contributions through practical activities, case studies, and project-based work.									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	PO10	PO11	PSO 01	PSO 02	PSO 03
CO1									2					
CO2	2								2					
CO3									2			2		
CO4		1							1					
CO5									2	2				2
CO6								2	2	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. 1. Seminar Presentation on ancient Tamil scientific and technological achievements (e.g., irrigation systems, architecture, metallurgy, maritime trade). 2. Group Discussion on the relevance of traditional Tamil knowledge systems in modern society. 3. Case Study Analysis of Tamil cultural heritage sites, monuments, and engineering marvels. 4. Documentary Viewing and Review on Tamil civilization, science, and culture. 5. Heritage Exhibition displaying charts, models, and photographs related to Tamil cultural and technological contributions. 6. Quiz and Debate on Tamil literary, scientific, and cultural achievements. 7. 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. 1. Mini Project on traditional Tamil technologies such as water management, agricultural practices, or indigenous architecture. 2. Model Making Activity depicting Tamil engineering achievements (e.g., Kallanai Dam, temple architecture, ancient ships). 3. Project Report Preparation on the modern applications of traditional Tamil knowledge systems. 4. Case Study Presentation comparing ancient Tamil technologies with contemporary technologies. 5. Practical Demonstration of traditional arts, crafts, folk practices, or indigenous techniques. 6. Poster and Infographic Creation highlighting Tamil scientific and technological contributions. 7. Community-Based Project documenting local traditional knowledge, folk practices, or cultural heritage and presenting the findings. 8. Digital Portfolio Development showcasing project outcomes, photographs, reports, and reflections on Tamil heritage and technology.

Rubrics for evaluation CO5

Sl. No.	Criterion	Marks	Excellent (9-10)	Good (6-8)	Satisfactory (1-5)
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 with minor shortcomings.	Content is organized and presented clearly with minor shortcomings.
5.	Communication Skills	8	Ideas are communicated clearly, confidently, and engagingly with appropriate supporting evidence.	Ideas are communicated clearly with moderate confidence and adequate support.	Communication is understandable but lacks clarity, confidence, or supporting evidence.
	Total	40			

Rubrics for evaluation CO6

Sl. No.	Criterion	Marks	Excellent (9-10)	Good (6-8)	Satisfactory (1-5)
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: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26MAC02	ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES B.E. (Common to CIVIL, ECE, MECH & METT)		SEMESTER			II	
Prerequisites		Category	BS	Credits			4
Basic knowledge of calculus, differential equations, complex numbers and elementary integration techniques.		Hours/ Semester	L	T	P	SL	TH
			45	15	-	60	120
COURSE OBJECTIVES							
1.	To understand the theory and solution methods of ordinary differential equations, including higher order equations, Euler–Cauchy equations, Legendre’s equations and systems of simultaneous differential equations.						
2.	To develop proficiency in Laplace transform techniques and their applications in solving initial value problems arising in science and engineering.						
3.	To acquire knowledge of Fourier series representations, harmonic analysis and Parseval’s identity for analyzing periodic functions.						
4.	To understand Fourier, transform methods, their properties and applications in solving problems related to signal analysis and integral transforms.						
5.	To learn the concepts of Z-transforms and difference equations and apply transform techniques for solving discrete mathematical and engineering models.						
UNIT - I		ORDINARY DIFFERENTIAL EQUATIONS					12
Homogeneous linear ordinary differential equations of second order – General solution – Particular integral – Solution by variation of parameters – Homogeneous equations of Euler–Cauchy and Legendre type – System of simultaneous linear differential equations with constant coefficients.							
UNIT - II		LAPLACE TRANSFORMS					12
Existence theorem – Transforms of standard functions – Transform of unit step function and Dirac delta function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Transform of periodic functions – Initial and final value theorems – Inverse Laplace transforms – Convolution theorem without proof – Solution of initial value problems using Laplace transform techniques.							
UNIT - III		FOURIER SERIES					12
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range sine and cosine series – Parseval’s identity – Computation of harmonics							
UNIT - IV		FOURIER TRANSFORMS					12
Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties of Fourier transforms – Transforms of elementary functions – Inverse Fourier transforms – Convolution theorem without proof – Parseval’s identity.							
UNIT - V		Z – TRANSFORM AND DIFFERENCE EQUATIONS					12
Z-transform – Properties of Z-transform – Inverse Z-transform – Convolution theorem – Evaluation of inverse Z-transform using partial fraction method and convolution theorem – Initial and final value theorems – Formation of difference equations – Solution of difference equations using Z-transform.							
L:45, T:15, SL:60, Total:120 Hours							

Weightage:

Continuous Assessment: 40%

End Semester Examinations: 60%

REFERENCE BOOKS:

1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, New Delhi, 2020.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Pvt Ltd., New Delhi, 2018.
3.	N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008
4.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017
5.	Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.

E-RESOURCES:

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

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

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

C04	Investigate and interpret mathematical models through assignments, case-based problems and transform techniques to develop logical reasoning and problem-solving skills for engineering applications.	PO3	PSO2
C05	Solve assignment-based analytical problems involving differential equations, Laplace transforms, Fourier series, Fourier transforms and Z-transforms by applying systematic mathematical procedures and computational techniques	PO5	PSO2
C06	Communicate mathematical concepts, transform techniques, solution procedures and results effectively through proper mathematical notation, graphical representation, computational output, assignments and structured report writing for engineering and applied science problems.	PO10	-

The Course Articulation Matrix (CAM) for defined Cos

	PO1	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
C01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C02	2	-	-	-	-	-	-	-	-	-	-	2	-	-
C03	-	2	-	-	-	-	-	-	-	-	-	2	-	-
C04	-	-	1	-	-	-	-	-	-	-	-	-	1	-
C05	-	-	-	-	3	-	-	-	-	-	-	-	1	-
C06	-	-	-	-	-	-	-	-	-	3	-	-	-	-

Activities:

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

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Selection and understanding of problem	8	Suitable analytical problem is selected and the concept is clearly understood	Problem is selected properly, but conceptual explanation needs minor improvement	Problem selection is basic and conceptual understanding is limited
2.	Application of mathematical method	8	Correct method is applied with clear step-by-step solution	Method is mostly correct with minor errors	Method is unclear or contains major errors
3.	Use of analytical/computational technique	8	Analytical or computational technique is used effectively and results are accurate	Technique is used properly, but minor computational/procedural errors are present	Technique usage is incomplete or not clearly demonstrated
4.	Accuracy and interpretation of results	8	Results are accurate and clearly interpreted with engineering/application relevance	Results are mostly correct, but interpretation needs improvement	Results are inaccurate or interpretation is weak
5.	Presentation and professional communication	8	Work is professionally presented with clear mathematical communication	Presentation is good with minor organizational issues	Presentation is satisfactory but lacks consistency
	Total	40			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Clarity of mathematical explanation	8	Concepts, formulae and solution procedures are explained clearly and correctly	Explanation is understandable, but needs minor improvement	Explanation is incomplete or unclear
2.	Use of mathematical notation, graphs and representation	8	Proper notation, equations, graphs, tables or computational outputs are used effectively	Notation and representation are mostly correct with minor errors	Notation is poor or graphical/computational representation is missing

3.	Organization of assignment/report/presentation	8	Report/presentation is well structured with problem statement, method, solution, result, interpretation and conclusion	Report/presentation is organized, but some sections need improvement	Report/presentation is poorly organized or incomplete
4.	Interpretation and communication of results	8	Results are interpreted clearly and communicated effectively with logical conclusion	Results are communicated properly, but interpretation is limited	Interpretation and communication of results are weak
5.	Overall presentation and academic quality	8	Work demonstrates excellent academic quality and professional presentation	Academic quality is good with minor issues	Academic presentation is satisfactory
	Total	40			

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

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

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

26ENC01		COMMUNICATIVE ENGLISH B.E. (Common to all Branches)		SEMESTER			II	
Prerequisites			Category	HM	Credits			2
Basic language skills listening, speaking, reading and writing			Hours/ Semester	L	T	P	SL	TH
				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%		
REFERENCE 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.	
3.	Viswamohan, Aysha. English for Technical Communication. McGraw-Hill Education, 2013.	
4.	Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principles and Practice. 3rd ed., Oxford University Press, 2015.	
5.	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	PSO1
CO4	Analyze technical and professional texts, reports, charts, and workplace documents to interpret, summarize, and present relevant information effectively.	PO9, PO11	-
CO5	Develop professional writing skills for drafting reports, emails, proposals, status reports, feasibility reports, and other workplace documents.	PO9, PO10, PO11	PSO3
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

	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	-	2	-	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	3	-	2	1	-	-
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:
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	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	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Understanding of Purpose and Audience	10	Clearly identifies the purpose, context, and target audience; content is highly relevant	Purpose and audience are identified with minor gaps in relevance	Purpose and audience are inadequately addressed
2.	Content Development and Organization	10	Content is comprehensive, logically organized, and professionally structured	Content is organized with minor omissions or inconsistencies	Content lacks organization and completeness
3.	Professional Writing and Communication	10	Uses appropriate tone, style, and workplace conventions effectively	Generally appropriate tone and style with minor errors	Tone, style, or workplace conventions are inappropriate or unclear

4.	Language, Formatting, and Accuracy	10	Excellent grammar, vocabulary, formatting, and document presentation with no significant errors	Minor grammatical, formatting, or language errors	Frequent errors in grammar, formatting, and presentation affecting readability
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Communication Skills	10	Communicates ideas clearly, confidently, and effectively using appropriate verbal and non-verbal communication	Communicates ideas adequately with minor clarity or delivery issues	Communication is unclear, hesitant, or ineffective
2.	Interpersonal and Teamwork Skills	10	Demonstrates excellent collaboration, active listening, respect for others, and conflict resolution skills	Participates effectively in teamwork with occasional guidance	Limited participation and difficulty in working with others
3.	Leadership and Decision-Making	10	Shows initiative, responsibility, problem-solving ability, and effective leadership in group activities	Demonstrates leadership qualities with minor limitations	Shows limited initiative and leadership ability
4.	Ethical, Social, and Professional Responsibility	10	Consistently demonstrates ethical behaviour, professionalism, accountability, and social responsibility	Demonstrates responsibility and professionalism with minor lapses	Shows inadequate awareness of ethical or professional responsibilities
	Total	40			

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

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

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

26CYC01		APPLIED CHEMISTRY		SEMESTER			II	
Prerequisites			Category	BS	Credits		4	
Basic Chemistry concepts			Hours/ Semester	L	T	P	SL	TH
				45	0	45	30	120
COURSE OBJECTIVES								
1.	To understand the fundamental scientific principles related to water chemistry, electrochemical systems, polymers, acid–base equilibria, corrosion phenomena, and spectroscopic techniques used in engineering applications.							
2.	To acquire the ability to apply chemical laws, numerical methods, and analytical reasoning for solving engineering problems involving water quality, electrochemical cells, buffer systems, corrosion, and instrumental analysis.							
3.	To examine the behaviour of chemical and material systems and interpret the influence of process parameters on performance in water treatment, electrochemical processes, corrosion control, polymers, and spectroscopy.							
4.	To assess different engineering materials, chemical processes, and analytical techniques for selecting suitable methods in industrial and technological applications.							
5.	To develop practical laboratory skills by performing experiments related to water analysis, electrochemistry, polymers, acid–base systems, corrosion studies, and spectroscopic measurements, and to interpret experimental data effectively.							
UNIT - I		WATER TECHNOLOGY						9+9
Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – dissolved oxygen significance – boiler troubles (scale and sludge, priming and foaming, caustic embrittlement and boiler corrosion) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) – External treatment – demineralization, zeolite process – desalination of brackish water – reverse osmosis. Practical: 1. Estimation of total hardness by EDTA method. 2. Estimation of alkalinity of water. Activity: 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. Activities: Comparing biodegradable and non-biodegradable polymers.		
UNIT - IV	ACID BASE CONCEPTS AND CORROSION	9+9
Acids and bases – Arrhenius concept – Bronsted-Lowry concept – Lewis concept – pH and pKa – buffer solutions – types – mechanism of buffer action – Henderson–Hasselbalch equation – derivation and problems. Corrosion – causes – types of corrosion – chemical, electrochemical corrosion (galvanic, differential aeration) – factors influencing the rate of corrosion – electrochemical protection – sacrificial anode method and impressed current cathodic method. Practical: 1. Estimation of strong acid by pH meter. 2. Estimation of pKa of weak acid by pH meter. Activity: 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

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 01	PSO 02	PSO 03
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	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. (C05) (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. (C06) (Independent study)

Rubrics for evaluation: C05

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

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Conceptual Clarity and Knowledge	10	Shows complete conceptual clarity with strong understanding and accurate knowledge.	Shows good conceptual clarity with minor errors.	Basic understanding with limited clarity and several gaps.
2.	Accuracy of Content / Answers	10	All answers are correct, precise, and scientifically accurate.	Most answers are correct with minor mistakes.	Some correct answers but several errors present.

3.	Application and Analytical Thinking	10	Effectively applies concepts to solve problems and analyze situations.	Applies concepts with minor difficulty in analysis.	Limited ability to apply concepts; mostly descriptive.
4.	Participation and Preparedness	10	Fully prepared, actively participates, and demonstrates strong engagement throughout the activity.	Well prepared and participates actively with minor gaps.	Partially prepared with limited participation or engagement.
	Total	40			

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

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					12	2
CO4					100	100	50	3
CO5			40				10	2
CO6				40			10	2
Total	60	60	40	40	100	100	100	

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

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

UNIT - IV	LASER	9+9	
Characteristics of laser light – absorption, spontaneous emission and stimulated emission – Einstein Co-efficient (derivation) – Population inversion – Pumping methods – Types of laser – Construction and working of Nd:YAG laser, 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%			
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	Analyze 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.	PO6, PO9	
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

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

Activities:

1.	Determination of physics concepts through virtual lab. (CO4) 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: CO4

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Concept Understanding	5	Clear understanding of physics concepts	Minor errors in explanation	Limited understanding
2.	Demonstration Skills	5	Procedure and demonstration are clear and systematic	Procedural mistakes	Incomplete demonstration
3.	Interpretation of results	5	Results are clearly interpreted & justified	Results are interpreted but limited justification	Unclear interpretation

4.	Team Participation and Collaboration	5	Actively participates and supports the team.	Participates regularly with moderate contribution.	Shows limited participation and contribution.
	Total	20			

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Subject Knowledge	10	Clearly explains the concept with relevant examples	Good explanation with minor gaps	Basic understanding of the topic
2.	Content Organization	10	Information is well-organized, clear, and logically presented	Organization is good with minor improvements needed	Average organization of content
3.	Communication Skills	10	Confident presentation with clear explanation and effective response to questions	Good communication with slight hesitation	Basic communication skills
	Total	30			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (4)	Good (3)	Satisfactory (2)
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	20	Reviews and compares multiple relevant research articles effectively	Reviews relevant articles with some comparison	Limited review of articles
3.	Analysis & Interpretation	10	Critically analyses the product performance, advantages, and limitations	Good analysis with minor shortcomings	Basic analysis provided
4.	Presentation & Communication	10	Well-organized report/presentation with clear communication and proper references	Organized presentation with minor errors	Average presentation and communication
	Total	50			

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

	Theory Component				Laboratory Component		Percentage allocation	Mapping Strength
CO	Test I	Test II	Activity I	Activity II	Observation and Record	Test		
CO1	20	20	-	-	-	-	10	1
CO2	22	22	-	-	20	20	21	2
CO3	18	18	-	-	20	20	19	2
CO4			20	-	60	60	35	3
CO5	-	-	20	-		-	5	1
CO6	-	-	-	40	-	-	10	2
Total	60	60	40	40	100	100	100	

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

26HMC02		தமிழரும் தொழில்நுட்பமும் B.E. - அனைத்து துறைகளுக்கும் பொதுவானது		பருவம்		II		
முன்தேவைகள்		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 இந்தோ 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 - எலும்புத்துண் டுகள் - 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	-	-	-	-	-	-	-	-	2	-	-	-	-	-
C02	2	-	-	-	-	-	-	-	2	-	-	-	-	-
C03	-	-	-	-	-	-	-	-	2	-	-	2	-	-
C04	-	2	-	-	-	-	-	-	2	-	-	-	-	-
C05	-	-	-	-	-	-	-	3	3	3	-	-	-	3
C06	-	-	-	-	-	-	-	-	3	3	-	-	-	3

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	10	10	-	-	10	2
CO2	16	16	-	-	16	2
CO3	18	16	-	-	17	2
CO4	16	18	-		17	1
CO5	-	-	40	-	20	3
CO6	-	-	-	40	20	3
Total	60	60	40	40	100	

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

26HMC02	TAMILS AND TECHNOLOGY B.E. (Common to all Branches)		SEMESTER				II	
Prerequisites			Category	HM	Credits			1
Basics of Tamil Language and Literature			Hours/ Semester	L	T	P	SL	TH
				15	0	0	15	30
COURSE OBJECTIVES								
1.	To obtain the knowledge of weaving and ceramic technology.							
2.	To familiarize about design and construction technology during Sangam age and British period.							
3.	To know about the manufacturing technologies.							
4.	To obtain the knowledge of agriculture and irrigation technology.							
5.	To know about the development of Scientific Tamil and Tamil computing.							
UNIT - I		WEAVING AND CERAMIC TECHNOLOGY						3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.								
UNIT - II		DESIGN AND CONSTRUCTION TECHNOLOGY						3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.								
UNIT - III		MANUFACTURING TECHNOLOGY						3
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.								
UNIT - IV		SCIENCE, TECHNOLOGY AND KNOWLEDGE SYSTEMS OF TAMILS						3
Agriculture and Irrigation Technology – Dam, Tank, Ponds and Sluice Systems – Significance of Kumizhi Thoompu 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 centers - 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	PSO01	PSO02	PSO03
CO1	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	-		-	-	-	-	-	-	2	-	-	2	-	-
CO4	-	2	-	-	-	-	-	-	2	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	3	3	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	3

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 (9-10)	Good (6-8)	Satisfactory (1-5)
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 (9-10)	Good (6-8)	Satisfactory (1-5)
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
CO1	10	10	-	-	10	2
CO2	16	16	-	-	16	2
CO3	18	16	-	-	17	2
CO4	16	18	-		17	1
CO5	-	-	40	-	20	3
CO6	-	-	-	40	20	3
Total	60	60	40	40	100	

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

26CSC01	C PROGRAMMING (Common to All Branches)		SEMESTER				II
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						15
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						15
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						15
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						15
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	15	
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.			
L:45, P:30, SL:45, Total:120 Hours			
Weightage: Continuous Assessment 50% End Semester Examinations 50%			
REFERENCE BOOKS:			
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.		
3.	Pradip Dey and Manas Ghosh, 'Programming in C'. Oxford University, New Delhi, 2018.		
4.	Mike McGrath, 'C Programming In Easy Steps Limited'. 5th edition, United Kingdom, 2018.		
5.	B.W. Kernighan and D.M. Ritchie, 'The C Programming Language'. 2nd edition, Pearson, New Delhi, 2015.		
6.	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			
CO1	Explain the fundamentals and core concepts of C programming.	-	PSO1
CO2	Apply programming skills to develop C programs for solving real world problems.	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	Make effective presentations on applications of C programming concepts as an individual.	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	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	-	-	-	-	-	-	-	-	-	-	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 (3)	Good (2)	Satisfactory (1)
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 (3)	Good (2)	Satisfactory (1)
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		

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

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

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Safety Practices & Discipline	20	Consistently follows all safety procedures independently	Uses tools accurately and independently with high proficiency	Follows safety procedures inconsistently
2.	Tool Handling & Technical Skills	20	Uses tools accurately and independently with high proficiency	Uses tools correctly with occasional support	Uses tools with frequent assistance
3.	Execution of Practical Work	25	Produces accurate work meeting specifications with excellent finish	Produces acceptable work with minor errors	Produces work with noticeable errors requiring correction
4.	Problem Solving & Application Skills	15	Identifies and solves problems independently with innovative approach	Identifies and solves problems independently with innovative approach	Requires continuous support for solving problems
5.	Teamwork & Participation	10	Actively contributes and works effectively in teams	Participates adequately in team activities	Limited participation in teamwork
6.	Documentation & Self-Learning	10	Well-maintained records with additional learning inputs	Records maintained with minor omissions	Incomplete records with limited learning evidence
	Total	100			

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

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

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

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

The Course Articulation Matrix (CAM) for defined Cos

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

Activities:

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

Rubrics for evaluation: CO5

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

Rubrics for evaluation: CO6

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

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

E-RESOURCES:

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

COURSE OUTCOMES (COs) /

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

Mapping POs

Mapping PSOs

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

The Course Articulation Matrix (CAM) for defined Cos

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

Activities:

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

Rubrics for evaluation: CO5

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

Rubrics for evaluation: CO6

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

26MAC04	PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES B.E. (Common to CIVIL, ECE, MECH & METT)		SEMESTER		III	
Prerequisites		Category	BS	Credits		3
Basic knowledge of calculus, differential equations, complex numbers and elementary vector calculus.		Hours/ Semester	L	T	P	SL
			45	15	0	30
COURSE OBJECTIVES						
1.	To understand the formation and solution methods of partial differential equations including first order and higher order linear equations.					
2.	To develop knowledge in solving boundary value problems using Fourier series and separation of variables techniques for heat and wave equations.					
3.	To acquire understanding of analytic functions, harmonic functions and conditions for analyticity in complex analysis.					
4.	To learn conformal mapping techniques and standard complex transformations used in mathematical and engineering applications.					
5.	To understand complex integration methods, residue theorem and contour integration techniques for evaluating complex and real integrals.					
UNIT - I						
PARTIAL DIFFERENTIAL EQUATIONS		12				
Formation of partial differential equations – Solutions of first-order partial differential equations – Standard types of first-order partial differential equations and equations reducible to standard types – Lagrange's linear equation – Solution of higher-order linear partial differential equations with constant coefficients – Linear non-homogeneous partial differential equations.						
UNIT - II		12				
APPLICATIONS OF FOURIER SERIES TO PARTIAL DIFFERENTIAL EQUATION		12				
Classification of partial differential equations – Method of separation of variables – Solutions of one-dimensional wave equation and one-dimensional heat equation – Steady-state solution of two-dimensional heat equation.						
UNIT - III		12				
ANALYTIC FUNCTIONS		12				
Analytic functions – Necessary and sufficient conditions for analyticity – Properties of analytic functions – Harmonic conjugates – Construction of analytic functions.						
UNIT - IV		12				
CONFORMAL MAPPING		12				
Introduction to complex mapping - Conformal mapping – Conditions for conformality – Standard mappings: $a + z, az, az + b, \frac{1}{z}, z^2, e^z$ and bilinear transformations.						
UNIT - V		12				
COMPLEX INTEGRATION		12				
Line integrals – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Cauchy's residue theorem – Applications of residue theorem to the evaluation of real integrals – Use of circular and semicircular contours excluding poles on the real axis.						
L:45, T:15, SL:30, Total:90 Hours						
Weightage:						
Continuous Assessment: 40%						
End Semester Examinations: 60%						

REFERENCE BOOKS:			
1.	Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley & Sons. , New Delhi, 2015.		
2.	Wylie C. R. and Barrett L. C, "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019.		
3.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45 th Edition, New Delhi, 2020.		
4.	Peter V.O Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt. Ltd., New Delhi, 2016.		
5.	Dennis G Zill, "Advanced Engineering Mathematics", Jones & Bartlett India P Ltd., New Delhi, 2017.		
E-RESOURCES:			
1.	NPTEL, "Partial Differential Equations", National Programme on Technology Enhanced Learning, https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ma28		
2.	NPTEL, "Complex Analysis", National Programme on Technology Enhanced Learning, https://nptel.ac.in/courses/111107056		
3.	MIT OpenCourseWare, "Differential Equations", Massachusetts Institute of Technology, https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/		
4.	Paul's Online Math Notes, "Partial Differential Equations and Complex Variables", Lamar University, https://tutorial.math.lamar.edu/classes/de/intropde.aspx		
5.	Wolfram Math World, "Partial Differential Equations, Analytic Functions, Conformal Mapping and Residue Theorem", Wolfram Research, https://mathworld.wolfram.com/AnalyticFunction.html		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Remember and understand the fundamental concepts and methods of partial differential equations, Fourier series applications, analytic functions, conformal mappings and complex integration, including PDE solution techniques, analyticity conditions, harmonic functions, mapping transformations, complex series expansions, and residue theory.	-	-
CO2	Apply the techniques of partial differential equations, Fourier series, analytic functions, conformal mappings and complex integration to solve mathematical and engineering problems involving heat and wave equations, complex transformations, contour integration and evaluation of real integrals using residue theory.	PO1	PSO1
CO3	Analyze mathematical and engineering problems using partial differential equations, Fourier series methods, analytic functions, conformal mappings and complex integration by selecting suitable analytical techniques, interpreting complex transformations, and examining the behaviour of functions and solutions in applied contexts.	PO2	PSO1
CO4	Develop mathematical models and analytical solution strategies using partial differential equations, Fourier methods, and complex analysis techniques for solving engineering and physical science problems.	PO3	PSO2
CO5	Investigate and solve assignment-based and application-oriented problems involving PDEs, conformal mappings and contour integration to enhance analytical reasoning and computational skills.	PO5	PSO2
CO6	Communicate mathematical concepts, analytical solution procedures, graphical interpretations and results related to partial differential equations and complex analysis effectively through proper mathematical notation, assignments, presentations and structured report writing.	PO10	--

The Course Articulation Matrix (CAM) for defined COs:														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-	1	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	1	-
CO6	-	-	-	-	-	-	-	-	-	3	-	-	-	-
Avg	2	2	1	-	3	-	-	-	-	3	-	2	1	-
Activities:														
1.	Students shall solve selected assignment-based problems involving partial differential equations, Fourier series applications, analytic functions, conformal mappings and contour integration using suitable analytical and computational methods. This activity develops analytical reasoning, computational skill, and problem-solving ability in applied mathematics.													
2.	Students shall prepare a short report or presentation on selected applications of PDEs, conformal mappings, analytic functions or residue theorem. This activity develops the ability to communicate mathematical procedures, graphical interpretations, results and conclusions effectively using proper notation and structured report writing.													
Rubrics for evaluation: CO5														
Sl. No.	Criterion	Marks	Excellent (9-10)		Good (6-8)		Satisfactory (1-5)							
1.	Selection of problem	8	Suitable application-based problem is selected and clearly understood		Problem is relevant, but needs minor clarity		Problem selection is basic or unclear							
2.	Application of analytical method	8	Correct method is applied with proper steps		Method is mostly correct with minor errors		Method is incomplete or incorrect							
3.	Accuracy of solution	8	Solution is accurate and well-presented		Minor errors are present		Major errors in solution							
4.	Interpretation of results	8	Results are clearly interpreted with conclusion		Interpretation is limited		Interpretation is weak or missing							

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

Rubrics for evaluation: CO6

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

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

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

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

26ME301	ENGINEERING THERMODYNAMICS		SEMESTER				III
Prerequisites		Category	ES(PC)	Credits			4
Engineering Physics and Engineering Chemistry fundamentals		Hours/ Semester	L	T	P	SL	TH
			45	15	-	60	120
COURSE OBJECTIVES							
1.	To analyze the fundamental concepts and laws of thermodynamics.						
2.	To evaluate the thermodynamic properties of pure substances and gas mixtures.						
3.	To analyze energy interactions in closed and open thermodynamic systems.						
4.	To evaluate the performance of thermodynamic power cycles.						
5.	To design and investigate thermodynamic systems through project-based and seminar based learning activities.						
UNIT - I	BASIC CONCEPTS AND FIRST LAW						12
Thermodynamic systems, properties, state and equilibrium, thermodynamic processes and cycles, Zeroth law of thermodynamics, temperature scales, work and heat interactions, First law of thermodynamics for closed systems, internal energy and enthalpy, PMM-I, energy analysis of engineering systems.							
UNIT - II	SECOND LAW OF THERMODYNAMICS						12
Limitations of First law, thermal energy reservoirs, heat engines, refrigerators and heat pumps, Kelvin-Planck and Clausius statements, equivalence of statements, Carnot theorem and Carnot cycle, entropy, entropy generation, availability and irreversibility, PMM-II.							
UNIT - III	PROPERTIES OF PURE SUBSTANCES						12
Pure substances, phase transformation process, P-V-T behavior, thermodynamic property diagrams, steam tables, dryness fraction, latent heat, ideal gas equation, specific heats, thermodynamic processes involving ideal gases and vapours.							
UNIT - IV	VAPOR POWER CYCLES						12
Properties of steam, Carnot vapor cycle, Rankine cycle, schematic layout and working principle, Rankine cycle efficiency, effect of operating parameters on Rankine cycle performance, boiler and condenser processes, methods to improve cycle efficiency — reheating, regeneration and superheating, comparison of vapor power cycles, applications in thermal power plants.							
UNIT - V	GAS MIXTURES & THERMODYNAMIC RELATIONSHIPS						12
Composition of a gas mixture, mass and mole fractions. Dalton’s law of partial pressures, Amagat’s law of additive volumes. Thermodynamic properties of gas mixtures: evaluation of internal energy, enthalpy, specific heats, and entropy changes. Thermodynamic relationships: exact differentials, Maxwell’s relations, Clausius-Clapeyron equation. Joule-Thomson coefficient and inversion curve. General relations for changes in internal energy, enthalpy, entropy, and specific heats							
L:45, T:15, SL:60, Total:120 Hours							
Weightage:							
Continuous Assessment 40%							
End Semester Examinations 60%							

REFERENCE BOOKS:														
1.	Nag, P.K., "Engineering Thermodynamics", 6th ed., McGraw Hill India, New Delhi, 2017.													
2.	Cengel, Y.A., Boles, M.A., and Kanoglu, M., "Thermodynamics: An Engineering Approach", 10th ed., McGraw Hill, 2023.													
3.	Borgnakke, C. and Sonntag, R.E., "Fundamentals of Thermodynamics", 10th ed., John Wiley, 2019.													
4.	Arora, C.P., "Thermodynamics", Tata McGraw Hill, New Delhi, 2003.													
5.	Potter, M.C. and Somerton, C.W., "Schaum's Outline of Thermodynamics for Engineers", 4th ed., McGraw-Hill, New York, 2020													
E-RESOURCES:														
1.	NPTEL - NOC: Engineering Thermodynamics — IIT Kanpur (Prof. D.P. Mishra)													
2.	Swayam - Applied Thermodynamics — IIT Madras													
3.	MIT OpenCourseWare - Advanced Thermodynamics (ME, Spring 2024)													
4.	learncheme.com - Thermodynamics Overview													
5.	Basic Thermodynamics — Prof. S.K. Som, IIT Kharagpur (YouTube)													
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, laws, and thermodynamic properties of pure substances and systems.											--		
CO2	Apply the First Law of Thermodynamics to determine energy interactions in closed and open thermodynamic systems.											PO1, PO2	PSO1	
CO3	Analyze entropy changes and irreversibility in thermodynamic processes using Second Law principles.											PO1, PO2	PSO2	
CO4	Analyze the performance of Rankine cycle systems for engineering applications.											PO2, PO3, PO4	PSO2	
CO5	Design and develop a thermodynamic model/project to improve energy conversion efficiency through collaborative learning activities.											PO3, PO5, PO9, PO11	PSO2, PSO3	
CO6	Formulate and present a seminar/open-ended experimental study on modern thermodynamic applications considering environmental and societal impacts.											PO6, PO7, PO9, PO10	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	3	-	-	-	-	-	-	-	-	3	-
CO5	-	2	3	-	3	-	-	-	3	-	3	-	2	3
CO6	-	-	-	-	-	3	3			3				

Activities:

1.	Mini Project on Thermodynamic Energy Conversion Systems (CO5)
2.	Technical Seminar Presentation on Contemporary Thermodynamic Applications (CO6) (Independent study)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Problem Formulation & Objectives	10	Problem clearly defined with measurable objectives	Objectives partially clear	Problem definition unclear
2.	Thermodynamic Analysis & Design	10	Accurate calculations and design justification	Minor calculation errors	Incomplete analysis
3.	Model Development / Simulation	10	Innovative and functional model developed	Model functional with minor issues	Incomplete model
4.	Interpretation of Results	5	Results critically interpreted	Partial interpretation	Poor interpretation
5.	Report & Presentation	5	Professional presentation and documentation	Moderate presentation quality	Poor communication
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Understanding of Concepts	10	Concepts explained accurately and critically	Adequate understanding	Limited understanding
2.	Literature Survey & Self-Learning	10	Extensive use of journals and technical sources	Moderate references used	Very limited references
3.	Data Interpretation & Analysis	10	Results critically analyzed	Partial analysis	Weak interpretation
4.	Environmental & Societal Impact	5	Impacts clearly evaluated	Basic discussion provided	Poor explanation
5.	Seminar Presentation & Communication	5	Highly effective communication	Acceptable presentation	Poor 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: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26ME302	FLUID MECHANICS AND MACHINERY		SEMESTER				III	
Prerequisites			Category	ES(PC)	Credits			3
1. Engineering Mathematics 2. Engineering Physics 3. Engineering Mechanics 4. Basic Thermodynamics			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
COURSE OBJECTIVES								
1.	To introduce the fundamental properties and behaviour of fluids under static and dynamic conditions.							
2.	To impart knowledge on fluid flow principles and flow measurement techniques used in engineering applications.							
3.	To develop the ability to analyse flow through pipes and evaluate associated energy losses and performance characteristics.							
4.	To provide understanding of the operating principles and performance of hydraulic turbines and pumps.							
5.	To develop the ability to select suitable hydraulic machines and communicate engineering solutions effectively through technical discussions and presentations.							
UNIT - I		PROPERTIES AND FLUID STATICS						9
Definition of fluid, continuum concept - Properties: density, specific weight, specific gravity, Viscosity and Newton's law of viscosity, Surface tension and capillarity (basic only) - Pressure measurement: simple and differential manometers - Hydrostatic forces on plane surfaces - Buoyancy and stability of floating bodies								
UNIT - II		FLUID KINEMATICS AND DYNAMICS						9
Types of flow (steady/unsteady, laminar/turbulent) - Streamline, path line, streamline - Continuity equation (1D only) - Bernoulli's equation and applications - Flow measurement: Venturimeter, orifice meter, pitot tube (basic working)								
UNIT - III		FLOW THROUGH PIPES						9
Laminar and turbulent flow (concept + Reynolds number) - Major losses (Darcy-Weisbach equation) - Minor losses (overview only) - Pipes in series and parallel – Power transmission - Basic idea of HGL and TEL								
UNIT - IV		TURBINES						9
Classification of turbines – Performance of Pelton wheel and Francis turbine, Kaplan turbine (working principle only) - Velocity triangles (simple inlet/outlet only) - Efficiency of turbines – Simulation of turbine using AI tool.								
UNIT - V		PUMPS						9
Classification of pumps - Centrifugal pump: working, components, performance - Reciprocating pump: working principle, components, performance - Cavitation and priming (concept only) – Simulation of Pumps using AI tool.								
L:45, SL:45, Total: 90 Hours								

Weightage: Continuous Assessment 40% End Semester Examinations 60%			
REFERENCE BOOKS:			
1.	R.K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications Pvt. Ltd., New Delhi.		
2.	Yunus A. Çengel and John M. Cimbala, Fluid Mechanics: Fundamentals and Applications, 4th Edition, McGraw Hill Education, 2019.		
3.	P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi.		
4.	Robert W. Fox, Alan T. McDonald and John W. Mitchell, Fox and McDonald's Introduction to Fluid Mechanics, 10th Edition, Wiley India Pvt. Ltd., New Delhi, 2021		
5.	R.K. Rajput, Fluid Mechanics and Hydraulic Machines, S. Chand & Company Ltd., New Delhi, 2016.		
E-RESOURCES:			
1.	NPTEL – Fluid Mechanics Courses, Video lectures and course materials from IIT faculty covering fluid mechanics and hydraulic machinery.		
2.	MIT OpenCourseWare – Fluid Mechanics, Free lecture notes, assignments, and video resources from Massachusetts Institute of Technology.		
3.	Virtual Labs by IITs, Interactive virtual experiments related to fluid flow, pumps, and turbines.		
4.	LearnChemE Educational Simulations Simulations and animations useful for understanding fluid flow concepts and engineering applications.		
5.	ANSYS Student Software Resources - Student access to CFD and fluid simulation tools for learning modern engineering applications.		
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 fluid mechanics and hydraulic machines, including fluid properties, fluid statics, fluid flow behavior, pipe flow characteristics, and the working principles of turbines and pumps.	--	
CO2	Apply the principles of fluid mechanics and hydraulic machines to solve problems related to fluid properties, fluid flow, pipe flow systems, turbines, and pumps.	PO1	
CO3	Analyze the behavior and performance of fluid flow systems, hydraulic turbines, and pumps using the fundamental principles of fluid mechanics and energy transfer.	PO1, PO2	
CO4	Evaluate the suitability and performance of hydraulic turbines, pumps, and pipe flow systems for practical engineering applications.	PO1, PO2,PO3,	
CO5	Apply AI-based engineering tools to simulate and analyze the performance of turbines and pumps through effective teamwork and professional practices.	PO5	
CO6	Demonstrate technical communication and teamwork skills through discussions, presentations, or case studies related to fluid mechanics and hydraulic machines.	PO8, PO9,	

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	2	3												
CO4	2	2	2	2										
CO5					3				2					
CO6								3	3					

Activities:

1.	Team-Based Simulation Assignment (CO5)
2.	Seminar Presentation/ Group Discussion / Assignment (CO6)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Use of AI/Modern Tool	10	Effectively uses simulation tools with accurate analysis	Uses tools with minor guidance	Limited understanding of tools
2.	Technical Understanding	10	Clearly explains turbine/pump performance analysis	Moderate understanding	Basic understanding only
3.	Teamwork	10	Active collaboration and contribution	Participates adequately	Limited participation
4.	Communication & Presentation	10	Clear, organized, and confident presentation	Acceptable presentation	Poor communication
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Technical understanding	10	Accurate and clear explanation	Minor conceptual gaps	Weak understanding
2.	Communication skill	10	Clear, confident, and organized	Adequate communication	Poor clarity
3.	Team participation	10	Active contribution and coordination	Moderate participation	Minimal involvement
4.	Presentation quality	10	Well-structured and professional	Acceptable structure	Poor 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: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26ME303	MATERIALS ENGINEERING		SEMESTER				III
Prerequisites		Category	ES(PC)	Credits			4
1. Engineering Physics 2. Engineering Chemistry 3. Engineering Materials Basics		Hours/ Semester	L	T	P	SL	TH
			45	0	45	30	120
COURSE OBJECTIVES							
1. To impart knowledge on structure, properties and behavior of engineering materials.							
2. To understand heat treatment processes and phase transformations in metals.							
3. To identify suitable ferrous and non-ferrous materials for engineering applications							
4. To understand mechanical properties and testing methods of materials.							
5. To acquire knowledge in non-destructive testing and surface engineering techniques.							
UNIT - I	PHASE DIAGRAMS						18
Crystal structures – Phases – Solid solutions – Compounds – Hume Rothery rules – Gibbs phase rule – Binary phase diagrams – Eutectic, Eutectoid and Peritectic systems – Lever rule – Equilibrium and non-equilibrium cooling – Iron-carbon equilibrium diagram – Ferrite and Austenite stabilizers – TTT and CCT diagrams.							
Laboratory Experiments:							
1. Metallographic sample preparation and Mounting							
2. Study of Metallurgical Microscope.							
3. Study of Iron–Carbon equilibrium diagram and microstructure observation of steels.							
UNIT - II	HEAT TREATMENT						18
Annealing – Stress relief – Recrystallization – Spheroidizing – Normalizing – Hardening and tempering – Hardenability – Jominy end quench test – Austempering – Martempering – Carburizing – Nitriding – Cyaniding – Flame hardening – Induction hardening – Heat treatment of non-ferrous alloys.							
Laboratory Experiments:							
1. Annealing of carbon steels-Heat treatment practice and Analysis							
2. Normalising of carbon steels – Heat treatment practice and Analysis							
3. Effect of quenching media on hardening of steel – Heat treatment practice and Analysis							
4. Effect of tempering temperature on hardened steel – Heat treatment practice and Analysis							
5. Effect of tempering time on hardened steel- Heat treatment practice and Analysis							
UNIT - III	FERROUS AND NON-FERROUS METALS						18
Plain carbon steels – Tool steels – HSLA steels – Stainless steels – Ferritic, Austenitic and Martensitic steels – Cast irons – Gray cast iron – White cast iron – Malleable cast iron – S.G iron – Copper alloys – Brass – Bronze – Cupronickel – Aluminium alloys – Bearing alloys.							
Laboratory Experiments:							
1. Microstructural study of plain carbon steels							
2. Microstructure of different types of cast iron in unetched condition							
3. Microstructure of different types of cast iron in etched condition							
4. Microstructure of different types of stainless steel							
Microstructural study of copper alloys and aluminium alloys.							

UNIT - IV	MECHANICAL PROPERTIES AND TESTING	18	
Mechanical properties of engineering materials – Plastic deformation – Slip and twinning – Creep – Fatigue – Fracture – Tensile test – Compression test – Shear test – Hardness testing – Brinell, Rockwell and Vickers hardness tests – Impact tests – Izod and Charpy tests.			
Laboratory Experiments:			
1. Tensile test on mild steel specimen using Universal Testing Machine (UTM).			
2. Hardness testing using Brinell, Rockwell and Vickers hardness testers.			
3. Impact testing of Metals (Charpy & Izod)			
4. Bend Test of Metals			
UNIT - V	NON-DESTRUCTIVE TESTING AND SURFACE ENGINEERING	18	
Radiographic testing – Ultrasonic testing – Magnetic particle inspection – Liquid penetrant inspection – Surface engineering – Diffusion techniques – Deposition methods – High and low energy beam methods – Surface engineering charts – Elastic contact mechanics.			
Laboratory Experiments:			
1. Ultrasonic Testing (UT) and Liquid Penetrant Testing (LPT) for defect identification.			
2. Surface coating / case hardening experiment using carburizing or nitriding technique.			
L:45, P:45, SL:30, Total:120 Hours			
Weightage:			
Continuous Assessment 50%			
End Semester Examinations 50%			
REFERENCE BOOKS:			
1.	William D. Callister, “Materials Science and Engineering”, Wiley India.2002		
2.	Raghavan V., “Materials Science and Engineering”, PHI Learning Pvt. Ltd.		
3.	James F Shackelford , "Introduction to Materials Science for Engineers", 7th Edition, Pearson Prentice Hall, 2009.		
4.	Donald R Askeland, Wendelin J Wright, "Essentials of Materials Science and Engineering", Cengage Learning, 2013.		
5.	Khanna O.P., “Materials Science and Metallurgy”, Dhanpat Rai Publications.		
6.	Sydney H. Avner, “Introduction to Physical Metallurgy”, McGraw Hill		
E-RESOURCES:			
1.	https://nptel.ac.in/		
2.	https://archive.nptel.ac.in/		
3.	https://www.matweb.com		
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Explain the structure, properties, and classification of ferrous and non-ferrous engineering materials.	--	
CO2	Apply phase diagram concepts and heat treatment principles to engineering materials.	PO1, PO2	PSO1
CO3	Analyze the behavior and mechanical properties of engineering materials under different loading conditions.	PO2, PO3	PSO2
CO4	Analyze material testing methods and interpret the results using suitable standards and techniques.	PO5	PSO2
CO5	Study non-destructive testing methods and surface engineering processes through self-learning activities.	PO6, PO9, PO10	PSO3
CO6	Evaluate engineering materials and surface treatment techniques considering industrial, societal, and sustainability aspects.	PO6, 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											3		
CO2	3	2										3		
CO3		3	3										3	
CO4					3								3	
CO5						3			3	3				3
CO6						3					3			3

Alternate Assessment Activities:

Sl. No.	Modes of Assessment Activities
1.	Quiz / Objective Test
2.	Assignment / Problem-Solving Exercises
3.	Laboratory Experiment & Observation
4.	Case Study / Material Failure Analysis
5.	Seminar / Technical Presentation

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Understanding of NDT methods and surface engineering	20	Clearly explains NDT techniques and surface engineering methods	Explanation needs minor improvement	Limited understanding of concepts
2.	Application and industrial relevance	30	Clearly discusses industrial applications with proper examples	Applications discussed with limited clarity	Applications poorly explained
3.	Evidence of self-learning	30	Uses relevant journals, standards, and technical references	Limited supporting references used	Very limited references used
4.	Presentation & communication	20	Presentation is clear, systematic, and technically strong	Presentation needs improvement	Poorly structured presentation
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Understanding torsional behavior	20	Clearly explains material selection and surface treatment concepts	Explanation needs improvement	Limited understanding of concepts

2.	Safety & Economic considerations	30	Clearly discusses safety, sustainability, and cost aspects	Safety and economic aspects discussed with limited clarity	Poorly explained
3.	Evidence of self-learning	30	Uses relevant journals, standards, and technical references	Limited supporting references used	Very limited references used
4.	Presentation & communication	20	Presentation is clear, systematic, and technically strong	Presentation needs improvement	Poorly structured presentation
	Total	100			

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

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

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

26ME304		MANUFACTURING TECHNOLOGY		SEMESTER			III		
Prerequisites				Category	ES(PC)	Credits			4
Fundamentals of Engineering Materials and their properties. Basic knowledge of manufacturing processes and workshop practices				Hours/ Semester	L	T	P	SL	TH
					45	0	45	30	120
COURSE OBJECTIVES									
1.	To make the students familiarize with various manufacturing processes and fabrication techniques of metals and design of casting.								
2.	To develop design concepts of various manufacturing processes.								
3.	Gain knowledge to select appropriate manufacturing processes for various parts.								
4.	To develop an entrepreneur skill among the students.								
5.	To evaluate and select plastic deformation processes for various parts								
UNIT - I		CASTING							18
Concepts of Manufacturing Process -Sand casting -Patterns -Design of Pattern, mould and cores- gating and risering design, solidification time calculation - Moulding machines - Core making. Special moulding processes – CO2 moulding; shell moulding, investment moulding, pressure die casting, centrifugal casting, casting defects.									
Practical Component:									
1. Introduction to Safety measures and First aid.									
2. Study of Casting process and tools									
3. Foundry: Greensand preparation- mould making practice.									
UNIT - II		WELDING							18
Classification of welding processes. Principles of Oxy-acetylene gas welding. Metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, Soldering and Brazing, Adhesive Bonding.									
Practical Component:									
1. Study of Gas Welding and equipment									
2. Welding: Resistance welding types, TIG Welding									
UNIT - III		METAL FORMING							18
Metallurgical aspects of metal forming, slip, twinning mechanics of plastic deformation, load estimation of bulk deformation processes, Hot working and cold working of metals, Forging processes – open, closed and impression die forging – forging operations. Rolling of metals– Types of Rolling mill – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types.									
Practical Component:									
1. Metal Forming Process Identification and Industrial Product Analysis									
2. Hot Working vs. Cold Working Comparative Study and Presentation									

UNIT - IV	SHAPING OF PLASTICS	18
Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding.		
Practical Component:		
1. Study of plastics and Polymers 2. Study of Plastics moulding techniques		
UNIT - V	SHEET METAL FORMING AND POWDER METALLURGY	18
Formability of Sheet Metal-Important Metal Characteristics for Sheet -metal Forming Operations - Shearing, Deep drawing, Bending operations- types of presses used, Super Plastic forming; Introduction to Powder Metallurgy– Principal steps involved – sintering and compacting techniques, Advantages, limitations and applications of powder metallurgy.		
Practical Component:		
1. Preparation of a U – Channel by Manual Bending 2. Manual deep drawing of a circular cup using a Simple die 3. Study and demonstration of press used in sheet metal operations 4. Preparation of a Powder metal compact by compaction and sintering		
L:45, P:45, SL:30, Total:120 Hours		
Weightage:		
Continuous Assessment 50%		
End Semester Examinations 50%		
REFERENCE BOOKS:		
1.	Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", 4/e, Pearson Education, Inc. 2007	
2.	Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.	
3.	H.S. Shan, Manufacturing Processes: Casting, Forming and Welding, Cambridge University Press.	
4.	R.K.Rajput, A Textbook of Manufacturing Technology, Firewall Media	
5.	Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley India	
E-RESOURCES:		
1.	https://nptel.ac.in/courses/112105126	
2.	https://nptel.ac.in/courses/112106227	
3.	https://nptel.ac.in/courses/112107145	
4.	https://nptel.ac.in/courses/112104031	
5.	https://nptel.ac.in/courses/113108051	

COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Explain the principles, process parameters, equipment, and applications of casting, welding, metal forming, plastic shaping, and powder metallurgy processes.	--	
CO2	Apply the concepts of mould design, welding methods, metal forming operations, plastic processing techniques, and sheet metal forming processes in manufacturing applications.	PO1	
CO3	Analyze the effects of process variables, defects, material behavior and process capabilities in casting, welding, forming, and powder metallurgy operations and design the welding joints of different welding methods and materials.	PO2, PO3	
CO4	Evaluate the performance, quality, economic feasibility, and industrial suitability of various manufacturing and forming processes for specific applications and exposure of suitable manufacturing solutions by selecting appropriate casting, welding, forming, plastic shaping, and powder metallurgy processes for engineering products.	PO4, PO5	
CO5	Understand the contribution of manufacturing and forming processes to industrial production, product development, and technological advancement and apply safe operating practices and precautionary measures in foundry, welding, forming, and plastics processing environments.	PO6, PO7	
CO6	Develop self-learning skills to update knowledge on modern manufacturing methods, advanced materials, and emerging technologies in advanced welding, smart forming, modern materials processing technologies and technical discussions .	PO9, PO10, PO11	

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

Alternate Assessment Activities:

Sl. No.	Modes of Assessment Activities
1.	Sheet metal forming processes to industrial production (CO5)
2.	Case Study (CO6)/ Technical Seminar Presentation (CO6) (Independent study)

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Knowledge of Sheet Metal Operations	10	Clearly explains forming operations with proper process sequence	Explains most operations correctly with minor inaccuracies	Provides only basic explanation of operations.
2.	Application and Process Selection	10	Correctly selects suitable sheet metal processes for industrial applications with justification.	Demonstrates good application knowledge with minor errors.	Limited ability to select appropriate manufacturing processes.
3.	Interpretation of results	10	Results are clearly interpreted & justified	Results are interpreted but limited justification	Unclear interpretation
4.	Report presentation	10	Report is clear and well structured	Report is structured, but needs improvement	Poorly structured report
	Total	40			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Analysis of Process Parameters and Defects	10	Clearly analyses process parameters, defects, causes, and corrective methods for multiple manufacturing processes.	Identifies important defects and parameters with adequate explanation.	Basic understanding of defects and process control.
2.	Innovation and Manufacturing Awareness	10	Demonstrates awareness of modern manufacturing trends and quality improvement,	Shows reasonable awareness of industrial manufacturing practices.	Limited knowledge of modern manufacturing developments.
3.	Evidence of self-learning	10	Use of relevant journals/sources	Limited sources	Very limited sources
4.	Presentation & Communication	10	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		
C01	12	12					6	1
C02	24	24			70	70	47	3
C03	12	12			20	20	16	2
C04	12	12			10	10	11	2
C05			40				10	2
C06				40			10	2
Total	60	60	40	40	100	100	100	

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

26ME305	MECHANICS OF MATERIALS		SEMESTER				III	
Prerequisites			Category	ES(PC)	Credits		3	
1.Engineering Mechanics			Hours/ Semester	L	T	P	SL	TH
				45	0	0	45	90
COURSE OBJECTIVES								
1.	To understand the fundamentals of stress, strain, elastic constants, and strain energy in simple and composite members subjected to axial, shear, thermal, and impact loads.							
2.	To analyze shear force, bending moment, and bending stresses in different types of beams and structural sections under transverse loading conditions.							
3.	To evaluate slope, deflection, and column stability using beam deflection methods and column theories for various end conditions.							
4.	To apply the principles of torsion, power transmission, and spring mechanics in the analysis and design of shafts and helical springs.							
5.	To examine stresses and deformations in thin pressure vessels and determine principal stresses and strains using analytical and Mohr’s circle methods.							
UNIT - I		CONCEPTS OF STRESS AND STRAIN						9
Axial and shear stresses and strains – Elastic limit – Hooke's law – lateral strain – Poisson's ratio – volumetric strain – relationship between elastic constants – factor of safety – Stepped bars, uniformly varying sections – stresses in composite bar due to axial force and temperature – Strain energy under gradual, sudden and impact loading								
UNIT - II		TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM						9
Beams – Types - Transverse loading on beams – Shear force and Bending moment in beams – Cantilever, Simply supported and over hanging beams – Points of Contraflexure – Theory of simple bending – Section modulus – Bending stress in symmetrical and unsymmetrical sections (Rectangular, circular, I & T sections only)								
UNIT - III		DEFLECTION OF BEAMS AND COLUMNS						9
Slope and deflection in determinate beams - Double integration method, Macaulay’s method, Moment area method. Euler’s theory of long Columns- Expression of crippling load for various end conditions - Rankine formula for columns.								
UNIT - IV		TORSION						9
Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Stresses in helical springs – Closed Coiled helical springs – springs in series and parallel.								
UNIT - V		THIN CYLINDERS & PRINCIPAL STRESSES AND STRAINS						9
Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders. State of stress at a point - Normal and Shear stresses on any plane - Principal stresses and strains in two dimension – Analytical method, Mohr’s circle method								
L:45, SL:45, Total:90 Hours								

Weightage: Continuous Assessment 40% End Semester Examinations 60%				
REFERENCE BOOKS:				
1.	Rajput.R. K., "Strength of Materials", S. Chand & Company Ltd., New Delhi 2018			
2.	Ferdinand P. Beer, E. Russell Johnston, John T. Dewolf, David F. Mazurek, Mechanics of Materials, 6th edition, McGraw-Hill, New York, 2012.			
3.	S S Rattan, "Strength of Materials", McGraw-Hill Education (India) Pvt. Ltd., 3rd edition, 2017			
4.	Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016			
5.	Singh. D.K., "Strength of Materials", Ane Books Pvt Ltd., New Delhi, 2021			
E-RESOURCES:				
1.	Nptel Lecture video : IITKGP, IIT Kharagpur https://nptel.ac.in/courses/105105108			
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 strength of materials and describe the stress, strain, deformation, and deflection behavior of axially loaded members and columns, beams, circular shafts, thin cylinders, and springs under various loading conditions.		--	
CO2	Apply fundamental principles of strength of materials to determine stress, strain and deformation for axially loaded members and columns, circular shafts, thin cylinders and springs.		PO1	
CO3	Analyze mechanical components such as axially loaded members and columns, beams through shear force and bending moment analysis, and design of shafts, thick and springs by evaluating stresses, strains, deformations, and deflections under various loading conditions.		PO2, PO3	
CO4	Analyze the given system using simulation tool to compute and present the findings through plots and diagrams.		PO5	
CO5	Study torsional analysis of various components such as shafts, pressure vessels and springs through self-learning activities and present the findings while considering societal and economic impacts.		PO6, PO9, PO10, PO11	
CO6	Study torsional analysis of various components such as shafts, pressure vessels and springs through self-learning activities and present the findings while considering societal and economic impacts.		PO6, PO9, PO10, 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					3									
CO5						3			3	3	3			
CO6						3			3	3	3			

Activities:

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

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Problem formulation & boundary conditions	10	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	10	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	10	Results are clearly interpreted & justified	Results are interpreted but limited justification	Unclear interpretation
4.	Report presentation	10	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 (3)	Good (2)	Satisfactory (1)
1.	Understanding torsional behavior	10	Clearly explains torsional stress, strain and deformation	Explanation needs improvement	Limited understanding
2.	Safety & Economic considerations	10	Clearly discusses safety aspects and material comparison cost	Safety aspects discussed but material comparison	Poorly explained

3.	Evidence of self-learning	10	Use of relevant journals/sources	Limited sources	Very limited sources
4.	Presentation & Communication	10	Presentation is clear and well-structured	Presentation needs improvement	Poorly structured
	Total	40			

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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%);

26CE306	STRENGTH OF MATERIALS AND FLUID MECHANICS LABORATORY		SEMESTER			III
Prerequisites		Category	ES(PC)	Credits		2
		Hours/ Semester	L	T	P	SL
			0	0	45	15
COURSE OBJECTIVES						
1.	To provide practical knowledge of the mechanical properties of engineering materials through tension, shear, impact, and hardness testing of metallic specimens.					
2.	To study the behavior of structural elements such as springs and beams under different loading conditions and compare experimental results with theoretical principles.					
3.	To determine hydraulic parameters such as discharge coefficients and friction losses in flow systems.					
4.	To understand the principles of fluid flow and evaluate flow characteristics through experimental investigations.					
5.	To study the performance characteristics of hydraulic turbines and pumps used in engineering applications.					
<u>STRENGTH OF MATERIALS LABORATORY</u> 1. Double shear test on mild steel rod 2. Tension Test on mild steel rod 3. Test of springs (Open coil and closed coil) 4. Impact test on a metallic specimen (Charpy Impact test) 5. Hardness tests on metallic specimen (Brinell & Rockwell) 6. Bending deflection test on beams						
<u>FLUID MECHANICS LABORATORY</u> 1. Determination of Friction factor of pipes 2. Performance characteristics of Pelton Wheel Turbine 3. Determination of the coefficient of discharge of orifice meter 4. Determination of the coefficient of discharge of venturi meter 5. Conducting experiments and drawing the characteristics curves of centrifugal pump 6. Conducting experiments and drawing the characteristics curves of reciprocating pump 7. Conducting experiments and drawing the characteristics curves of gear pump						
L:45, SL:15, Total:60 Hours						
Weightage: Continuous Assessment 60% End Semester Examinations 40%						
REFERENCE BOOKS:						
1.	S. Ramamrutham and R. Narayanan, Strength of Materials, Dhanpat Rai Publishing.					
2.	R.K. Bansal, A Textbook of Strength of Materials, Laxmi Publications.					
3.	R.K. Rajput, A Textbook of Fluid Mechanics and Hydraulic Machines, S. Chand & Company.					
4.	Modi and Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House.					

E-RESOURCES:														
1.	NPTEL – Strength of Materials, IIT Madras www.nptel.ac.in/courses/112106141													
2.	NPTEL – Strength of Materials, IIT Madras & IIT Guwahati www.nptel.ac.in/courses/112106319													
3.	Virtual Labs – Fluid Mechanics, IIT Kanpur www.fm-iitk.vlabs.ac.in													
4.	NITK Remote Triggered Laboratories – Strength of Materials & Fluid Mechanics www.rtlabs.nitk.ac.in													
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to										Mapping POs		Mapping PSOs		
CO1	Evaluate the mechanical properties, strength, stiffness, and load–deformation characteristics of engineering materials and structural elements under various loading conditions through standard experimental methods.									–		–		
CO2	Analyze the flexural behavior and deformation response of structural members by interpreting experimental data and correlating the results with theoretical principles.									PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO11		PSO1, PSO2, PSO3		
CO3	Determine the hydraulic characteristics of fluid flow systems by conducting experiments on pipes and flow measuring devices and interpreting the obtained results.									PO1, PO2, PO4, PO5, PO9, PO11		PSO1, PSO2, PSO3		
CO4	Evaluate the performance characteristics of hydraulic machines through experimental investigations and analyze their suitability for engineering applications.									PO1, PO2, PO4, PO5, PO11		PSO1, PSO2, PSO3		
CO5	Conduct an independent study on the response of materials or structural components under loading conditions and present findings based on experimental observations and engineering principles.									PO1, PO2, PO4, PO5, PO8, PO9, PO10, PO11		PSO1, PSO2, PSO3		
CO6	Compare the performance characteristics of centrifugal, reciprocating and gear pumps and recommend suitable pumping systems for civil engineering applications based on operational requirements and engineering considerations.									PO1, PO2, PO4, PO5, PO11		PSO1, PSO2, PSO3		
The Course Articulation Matrix (CAM) for defined Cos														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 01	PSO 02	PSO 03
CO1														
CO2	3	3	1	3	2			1	1		1	2	3	1
CO3	2	2		3	1			2	3	1	3	1	2	3
CO4	3	3		3	3						2	3	3	3
CO5	3	3		3	2			1	2	2	2	3	3	3
CO6	3	3		3	3						2	3	3	3

Activities: Strength of Materials Laboratory

- 1. Machine Component Identification and Loading Analysis(CO5)**
Students identify machine components from everyday mechanical systems (bicycle, motorcycle, pump, crane, lathe, etc.) and classify the type of loading acting on them (tension, shear, bending, impact).
- 2. Comparative Study of Pumps Used in Civil Engineering Systems (CO6)**
Students compare the performance characteristics of centrifugal, reciprocating and gear pumps and recommend suitable pumps for various civil engineering applications. The selection shall be justified based on discharge requirements, head, efficiency, maintenance aspects and economic considerations.

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Identification of Machine Components and Load Types	05	Correctly identifies all components and accurately classifies load types (tension, shear, bending, impact) with clear understanding	Minor errors in identifying components or classifying load types	Incomplete or partially incorrect identification of components and load types
2.	Clarity of Presentation and Engineering Justification	05	Presents findings clearly using neat diagrams or charts and provides strong, logical justification for the type of loading acting on each mechanical component.	Presentation is clear but lacks depth or minor issues in explanation or diagrams	Poor presentation with weak or unclear justification of loading conditions
	Total	10			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Comparative Analysis of Pump Characteristics	05	Accurately compares centrifugal, reciprocating and gear pumps based on discharge, head, efficiency and operating characteristics	Comparison is mostly correct with minor omissions	Comparison is incomplete with limited understanding
2.	Selection and Engineering Justification	05	Correctly recommends the most suitable pump for each application with strong engineering justification	Recommendation is appropriate with minor gaps in justification	Recommendation is partially correct with weak technical reasoning
	Total	10			

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

CO	Laboratory component		Percentage allocation	Mapping Strength
	Evaluation of Student Work, Observation of Record and Model Test	Activities		
C01	20		20	2
C02	30		30	3
C03	30		30	3
C04	20		20	2
C05		50	20	2
C06		50	20	2
Total	100	100	100	

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

26MCC02	ENVIRONMENTAL SCIENCE AND ENGINEERING		SEMESTER				III	
Prerequisites			Category	MC	Credits			3
			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 1. Carbon footprint estimation of an individual or institution.		
UNIT - V	ENVIRONMENTAL SUSTAINABILITY 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 1. 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		
CO1	Explain the principles of ecology, biodiversity, environmental pollution, sustainable energy resources, climate change, and environmental sustainability.	Mapping POs -
CO2	Apply environmental concepts and scientific principles to analyze ecosystem functions, pollution problems, biodiversity conservation, and sustainable energy utilization.	Mapping POs PO1 -

C03	Analyze environmental challenges by correlating ecological processes, pollution impacts, climate change effects, and sustainability indicators.	PO2,PO7	-
C04	Assess renewable energy technologies, climate management strategies, environmental policies, and sustainability practices for engineering applications.	PO3,PO7	-
C05	Perform environmental observations, field studies, sustainability assessments, and activity-based investigations, and interpret the results using scientific methods.	PO8	-
C06	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	PO10	PO11	PSO01	PSO02	PSO03
C01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C02	3	-	-	-	-	-	-	-	-	-	-	-	-	-
C03	-	3	-	-	-	-	3	-	-	-	-	-	-	-
C04	-	-	-	-	-	2	2	-	-	-	-	-	-	-
C05	-	-	-	-	-	-	-	2	-	-	-	-	-	-
C06	-	-	-	-	-	-	-	-	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. (C05) (Individual and Collaborative Team Work)
2.	1. A comprehensive environmental impact assessment study on environmental sustainability, public welfare, regulatory compliance, and ethical responsibilities. (C04) (Independent study) 2. 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. (C06) (Independent study)

Rubrics for evaluation: CO4					
Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Environmental Sustainability Assessment	10	Comprehensive evaluation of environmental impacts and sustainability measures with strong supporting evidence.	Adequate evaluation of major environmental impacts and sustainability aspects.	Limited or incomplete assessment of environmental sustainability.
2.	Public Welfare and Societal Impact Analysis	5	Thorough analysis of impacts on public health, safety, and community welfare with clear justification.	Identifies key societal impacts with moderate analysis.	Limited discussion of public welfare and societal impacts.
3.	Regulatory Compliance Evaluation	5	Clearly assesses compliance with relevant environmental laws, regulations, and standards.	Addresses major regulatory requirements with some gaps.	Minimal or inaccurate assessment of regulatory compliance.
	Total	20			
Rubrics for evaluation: CO5					
Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Understanding of Environmental Concepts	10	Demonstrates thorough understanding and accurate interpretation	Good understanding with minor gaps	Basic understanding
2.	Data Collection and Observation	10	Accurate, systematic, and comprehensive observations	Mostly accurate observations	Adequate observations
3.	Analysis and Interpretation	10	Excellent scientific analysis and interpretation	Good analysis with minor errors	Basic analysis
4.	Report/Presentation Quality	10	Clear, organized, and professional	Well organized with minor issues	Moderately organized
	Total	40			
Rubrics for evaluation: CO6					
Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Conceptual Clarity	10	Complete understanding and clarity	Good understanding	Moderate understanding

2.	Accuracy of Content	5	Scientifically accurate and comprehensive	Mostly accurate	Some inaccuracies
3.	Participation and Preparedness	5	Highly engaged and well prepared	Well prepared	Partially prepared
	Total	20			

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

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

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

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

E-RESOURCES:

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

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

The Course Articulation Matrix (CAM) for defined Cos

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

Activities:

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

Rubrics for evaluation: C05

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

Rubrics for evaluation: C06

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

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

E-RESOURCES:

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

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

The Course Articulation Matrix (CAM) for defined Cos

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

Activities:

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

Rubrics for evaluation: C05

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

Rubrics for evaluation: C06

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

26ME401	THEORY OF MACHINES		SEMESTER				IV
Prerequisites		Category	ES(PC)	Credits			4
1. Engineering Mechanic 2. Engineering Mathematics.		Hours/ Semester	L	T	P	SL	TH
			45	0	45	30	120
COURSE OBJECTIVES							
1.	To understand the fundamentals of mechanisms and motion analysis.						
2.	To study the construction and operation of cams, gears, and friction drives.						
3.	To analyse forces and balancing in rotating and reciprocating systems.						
4.	To understand the principles and applications of mechanical vibrations.						
5.	To study the working of flywheels, governors, and gyroscopic systems.						
UNIT - I	FUNDAMENTAL ANALYSIS OF MECHANISM						18
Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider-crank chains – Velocities in a slider crank mechanism by relative velocity method - Rubbing Velocity - and acceleration in a slider crank mechanism analysis of mechanisms							
Practical Components:							
1. Demonstration of inversions of four-bar chain and slider crank mechanism.							
2. Velocity and acceleration analysis using graphical methods/software tools.							
UNIT - II	CAM, GEAR MECHANISMS						18
Classification of cams and followers- Terminology and definitions- Displacement diagrams Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions. Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio – Velocity ratio of epicyclic gear train.							
Practical Components:							
1. Study about the Cam follower arrangement, velocity and acceleration analysis.							
2. Study of gear terminology and gear tooth profiles.							
UNIT - III	FORCE ANALYSIS AND BALANCING						18
Static force analysis, Free body diagrams, Conditions of two, three and four force members. Inertia forces and D'Alembert's Principle – Inertia force analysis in reciprocating engine - Balancing of several masses rotating in the same plane - Partial balancing in locomotive Engines							
Practical Components:							
1. Determination of moment of inertia of a connecting rod							
2. Determination of radius of gyration and the natural frequency of the compound pendulum.							
3. Determination of unbalanced forces in rotating systems.							
4. Balancing of reciprocating masses in engines							
UNIT - IV	VIBRATION						18
Introduction to Vibration – Natural frequency of Free Longitudinal & Transverse vibrations – Dunkerley's method - Critical speed - Damped free vibration of single degree freedom system - Types of damping – Free vibration with viscous damping, Critically damped system, Under damped system - Logarithmic Decrement.							
Practical Components:							
1. Determination of natural frequency of spring-mass systems.							
2. Determination of critical speed of a shaft of various sizes.							
3. Observation of damping effects in vibrating systems.							

UNIT - V	FLYWHEEL AND GOVERNOR	18	
Flywheels – Turning moment diagrams and fluctuation of energy of reciprocating engine mechanisms, Coefficient of fluctuation of energy and speed, Weight of flywheel required. Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors – Terms used in governors			
Practical Components: 1.Determination of fluctuation of energy and speed in flywheels 2.Determination of range sensitivity and governor effect of centrifugal governors.			
L:45, P:45, SL:30, Total:120 Hours			
Weightage: Continuous Assessment 50% End Semester Examinations 50%			
REFERENCE BOOKS:			
1.	S. S. Rattan, Theory of Machines, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2019.		
2.	Sadhu Singh, Theory of Machines, Prentice Hall of India, New Delhi, 2013.		
3.	John J Uicker and Joesph E Shigley, Theory of Machines and Mechanism, Oxford University Press, United States of America, 2017		
4.	A Ghosh and A K Mallik, Theory of Mechanisms and Machines, East-West Press (P) Ltd. New Delhi. 2018		
5.	Ballaney, P.L., "Theory of Machines and Mechanisms", Khanna Publishers, New Delhi, 2002.		
E-RESOURCES:			
1.	https://nptel.ac.in/courses/112104121		
2.	http://digimat.in/nptel/courses/video/112106270/L15.html		
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 kinematics, cam mechanisms, gear systems, force analysis, balancing, vibrations, flywheels and governors in mechanical systems.	--	
CO2	Analyze velocity, acceleration, force transmission, balancing and vibration characteristics of machine elements and mechanisms using engineering fundamentals.	PO1	
CO3	Apply mechanism and machine dynamics concepts to solve engineering problems related to cams, gears, reciprocating systems, flywheels and governors.	PO2	
CO4	Evaluate the performance of mechanical systems through analytical methods, experimental studies and practical investigations on machine dynamics	PO3	
CO5	Utilize modern engineering tools and software for simulation, analysis and visualization of mechanisms, gear trains, balancing and vibration systems.	PO5	PSO1
CO6	Demonstrate self-learning, teamwork, technical communication and professional skills through model demonstrations, case studies and technical report preparation related to machine dynamics applications.	PO9, PO10, PO11	PSO2

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												
CO4			3											
CO5					3							3		
CO6									3	3	3		3	

Alternate Assessment Activities:

Sl. No.	Modes of Assessment Activities
1.	Software Simulation and Analysis (CO5)
2.	Model Demonstration and Technical Report (CO6)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Software Usage	10	Uses software tools accurately with complete analysis	Uses software with minor errors	Uses software with guidance
2.	Simulation & Analysis	10	Performs correct simulation and interpretation of results	Performs simulation with moderate accuracy	Performs basic simulation only
3.	Visualization & Presentation	10	Presents clear models, graphs and outputs effectively	Presents outputs with limited clarity	Presents incomplete outputs
4.	Technical Understanding	10	Demonstrates strong understanding of engineering concepts	Demonstrates moderate understanding	Demonstrates basic understanding
	Total	40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Model Demonstration	10	Demonstrates model clearly with proper explanation	Demonstrates model with minor limitations	Demonstrates model with basic explanation

2.	Teamwork & Participation	10	Actively contributes and collaborates effectively	Participates with moderate contribution	Limited participation
3.	Technical Report Preparation	10	Report is well organized with complete technical content	Report contains adequate technical details	Report contains basic information only
4.	Communication Skills	10	Communicates ideas clearly and confidently	Communicates with moderate clarity	Communicates with difficulty
	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: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26ME402	THERMAL ENGINEERING		SEMESTER				IV
Prerequisites		Category	ES(PC)	Credits			4
1. Engineering Physics and Chemistry 2. Engineering Thermodynamics		Hours/ Semester	L	T	P	SL	TH
			45	0	45	30	120
COURSE OBJECTIVES							
1.	To evaluate performance parameters, timing loops, and air-standard efficiencies of IC engines and gas power cycles.						
2.	To analyze fluid flow, critical pressure limits, and velocity diagrams across steam nozzles and turbines.						
3.	To compute operational work inputs and volumetric efficiencies for reciprocating and rotary air compressors.						
4.	To analyze moist air property transformations using psychrometric charts and process relationships.						
5.	To evaluate performance coefficients of vapor compression and absorption refrigeration systems using programming and experimental layouts.						
UNIT - I		INTERNAL COMBUSTION ENGINES AND GAS POWER CYCLES					18
Classification of IC engine, IC engine components and functions. Valve timing diagram and port timing diagram. Comparison of two stroke and four stroke engines, Actual and theoretical P-V diagram of two and four stroke engines, Performance calculation. Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency.							
Practical Component:							
1. Valve Timing Diagrams on a 4-stroke engine.							
2. Port Timing Diagrams on a 2-stroke IC engine test rig.							
3. Performance evaluation of a single-cylinder engine to compute Brake Power (BP) and Specific Fuel Consumption (SFC).							
4. Measurement of flash point and fire point indicators of steam turbine lubricating oils using a closed-cup apparatus.							
5. Determination of kinematic and absolute viscosity trends of thermal fluids using a Redwood Viscometer setup.							
UNIT - II		STEAM NOZZLES AND TURBINES					18
Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Principles of Impulse and Reaction Turbines, Compounding of Impulse Turbines. Velocity Diagrams, work done and efficiency for simple turbines.							
Practical Component: Nil							
UNIT - III		AIR COMPRESSORS					18
Classification and comparison, working principle, work of compression - with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors.							
Practical Component:							
1. Testing a multi-stage Reciprocating Air Compressor rig to calculate volumetric and isothermal efficiencies under variable delivery pressures.							
2. Comparative study and structural tracing of rotary vane/scroll compressor configurations vs reciprocating piston setups.							

UNIT - IV	REFRIGERATION SYSTEMS	18
Vapour compression Refrigeration cycle - Effect of suction and delivery pressures, super heat and sub cooling, performance calculations. Working principle of vapour absorption system. Comparison between vapour compression and absorption systems. Industrial configurations and eco-friendly refrigerant criteria. Practical Component 1. Industrial Case Study Activity (CO5): Comprehensive thermodynamic parametric analysis and performance evaluation of an industrial VCR plant using real-world operational logs. 2. Open-Ended Experiment (CO6): Designing and developing a localized insulation wrap or micro-cooling box to track real-time transient heat isolation profiles.		
UNIT - V	PSYCHROMETRY	18
Psychrometric properties - Property calculations using Psychrometric chart and expressions. Psychrometric processes using Psychrometric chart – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Practical Component: 1. Measurement of Dry Bulb Temperature (DBT) and Wet Bulb Temperature (WBT) to calculate relative humidity, enthalpy, and dew point using a sling psychrometer. 2. Experimental evaluation of an air conditioning unit to plot sensible cooling and dehumidification loops directly onto a psychrometric chart.		
L:45, P:45, SL:30, Total: 120 Hours		
Weightage: Continuous Assessment 50% End Semester Examinations 50%		
REFERENCE BOOKS:		
1.	Holman, J.P., "Thermodynamics", <u>McGraw Hill Education</u> , 4th Edition, 2002.	
2.	Arora, C.P., "Refrigeration and Air Conditioning", <u>McGraw Hill Education India</u> , 4th Edition, 2021.	
3.	Kothandaraman, C.P., Domkundwar, S., and Domkundwar, A.V., "A Course in Thermal Engineering", <u>Dhanpat Rai and Co.</u> , 6th Edition, 2016.	
4.	Sarkar, B.K., "Thermal Engineering", <u>Tata McGraw Hill</u> , 1st Edition (Reprint), 2005.	
E-RESOURCES:		
1.	<u>NPTEL Web Course: Thermal Engineering</u>	
2.	<u>NPTEL Video Course: Applied Thermodynamics</u>	
3.	MIT Open CourseWare: Internal Combustion Engines	
4.	<u>SWAYAM - Video Course: Refrigeration and Air-Conditioning</u>	

COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to		Mapping POs	Mapping PSOs
CO1	Explain IC engine components, valve/port timing steps, and air-standard gas power cycles	-	-
CO2	Compute engine efficiency metrics and analyze thermodynamic process lines on actual vs theoretical P-V charts	PO1, PO2	PSO1
CO3	Analyze steam expansion ratios in nozzles and construct velocity diagrams to evaluate turbine work outputs	PO1, PO2	PSO2
CO4	Calculate volumetric efficiencies for reciprocating/rotary compressors and evaluate psychrometric air properties	PO2, PO3, PO4	PSO2
CO5	Design and write a simulation code script to track VCR cycle performance variations under superheating and sub-cooling inputs	PO3, PO5, PO9, PO11	PSO2, PSO3
CO6	Formulate and test an open-ended refrigeration insulation layout while analyzing its environmental and lifecycle design metrics	PO6, PO7, PO9, PO10	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	3	-	-	-	-	-	-	-	-	3	-
CO5	-	2	3	-	3	-	-	-	3	-	3	-	2	3
CO6	-	-	-	-	-	3	3	3	3	3	-	-	-	3

Alternate Assessment Activities:

Sl No.	Modes of Assessment Activities
1.	Industrial Case Study & Performance Audit
2.	Technical Seminar & Policy Review

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Data Extraction & Thermodynamic Modeling	10	Extracts variables perfectly; constructs complete P-h/T-s operational models.	Minor errors in capturing transient states from plant log sheets.	Incomplete system mapping; incorrect fluid properties.
2.	Energy & COP Calculations	10	Flawless computation of refrigeration effect, compressor work, and exact COP.	Minor calculation slips in tracking sub-cooling/superheating margins.	Major mathematical errors; baseline deviations break the thermodynamic model.
3.	Optimization Solutions	10	Proposes highly creative, realistic modifications to lower power use.	Proposes generic optimization strategies with shallow engineering logic.	Fails to suggest viable design corrections for the audited system.

4.	Engineering Insight & Trends	10	Clear analysis connecting delivery pressure spikes directly to COP drops.	Superficial overview matching data curves to standard textbook charts.	Faulty conclusions contradicting basic thermal principles.
Total		40			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Technical Depth & Synthesis of Literature	10	Comprehensive review of peer-reviewed journals; clear breakdown of thermodynamics.	Relies mostly on basic textbooks; sound mechanics but limited novelty.	Superficial content summary; technical equations lack context.
2.	Environmental, Policy & Societal Analysis	10	Explicit, data-backed analysis of global warming potential (GWP) and energy safety.	General statements on sustainability with missing regulatory standards.	No consideration of carbon footprint, lifecycle safety, or policy frameworks.
3.	Slide Architecture & Visual Quality	10	Highly professional; clear schematic flow diagrams and minimal text.	Clean layout but relies heavily on walls of copied bullet points.	Poorly formatted; illegible graphs or low-resolution schematics.
4.	Presentation Delivery & Time Management	5	Flawless pacing; dynamic communication using precise terminology.	Clear presentation but lacks audience engagement or runs slightly over time.	Inaudible, monotone delivery; reads directly off the slides.
5.	Technical Viva & Question Defense	5	Confident, precise answers demonstrating high-order problem-solving skills.	Handles standard thermodynamic queries but struggles with edge cases.	Unable to justify assumptions or answer basic core questions.
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: Purely as an Example: Strength = 3 (if percentage >20%);

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

[illegible]

UNIT - V		ADVANCES IN MACHINING		18
Unconventional machining processes - principles, process parameters, MRR, process capabilities and tooling for Abrasive Jet Machining (AJM), Electrochemical Machining (ECM). Electric Discharge Machining (EDM), Laser Beam Machining (LBM). Additive manufacturing processes - Fundamentals of Additive Manufacturing (AM)-Product Development-Materials for AM Stereolithography apparatus - STL file - Fused Deposition Modeling - Laminated Object Manufacturing- Selective Laser sintering 3D Printer. Practical Component: Nil				
				L:45, P:45, SL:30, Total: 120 Hours
Weightage: Continuous Assessment 50% End Semester Examinations 50%				
REFERENCE BOOKS:				
1.	Kalpakjian and Schmid, "Manufacturing processes for Engineering Materials" (5th Edition) - Pearson India, 2014.			
2.	Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013			
3.	R.K. Jain and S.C. Gupta, "Production Technology" Khanna Publishers			
4.	P.C. Pandey and H.S. Shan, Modern Machining Processes, Tata McGraw Hill			
5.	Ian Gibson, David Rosen and Brent Stucker, Additive Manufacturing Technologies, Springer			
E-RESOURCES:				
1.	https://nptel.ac.in/courses/112105126			
2.	https://nptel.ac.in/courses/112103174			
3.	https://nptel.ac.in/courses/112107309			
4.	https://ocw.mit.edu/courses/2-830j-control-of-manufacturing-processes-sma-6303-spring-2008/			
5.	https://www.coursera.org/specializations/digital-manufacturing-design-technology			
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 metal cutting, chip formation, machining forces, cutting tools, tool wear, surface finish, and machining processes involved in conventional and unconventional manufacturing.		--	
CO2	Apply the working principles and operational procedures of lathes, shaping, planing, drilling, broaching, grinding, milling, and gear generating machines for machining applications.		PO1	
CO3	Analyze orthogonal metal cutting processes and evaluate thermal aspects, selection of suitable machines, tools, cutters, gear manufacturing methods, AM processes for given applications and design the milling cutters of different cutting tool materials.		PO2, PO3	
CO4	Evaluate the machining performance, tool life, MRR, gear manufacturing and comparison of conventional and unconventional processes. Extensive exposure to modern manufacturing tools such as EDM, ECM, LBM.		PO4, PO5	
CO5	Select and apply suitable Additive Manufacturing processes and 3D printing techniques for product development based on material, geometry, accuracy, functionality, and manufacturing requirements.		PO6, PO7	

CO6	Develop self-learning ability to update knowledge and technical presentations with exposure to emerging technologies such as advanced machining processes.										PO9, PO10, 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	2												
CO4				3	3										
CO5						3	3								
CO6									3	3	3				
Activities:															
1.	Performance Indicators using presentation (CO5) 1. Analyze product requirements such as geometry, material, accuracy, and functionality. 2. Select a suitable Additive Manufacturing process and 3D printing technology for a given application Evaluate the selected AM process based on quality, cost, production time, accuracy, and material suitability.														
2.	Technical Seminar Presentation (CO6) (Independent study) 1. Demonstrate awareness of emerging Advanced Machining Processes and their recent developments. Analyze and compare emerging machining technologies based on working principles, capabilities, applications, advantages, and limitations.														
Rubrics for evaluation: CO5															
Sl. No.	Criterion			Marks	Excellent (3)			Good (2)			Satisfactory (1)				
1.	Analyze product requirements			15	Analyzes geometry, material, functionality, and requirements.			Analyzes most product requirements correctly.			Identifies basic product requirements with limited analysis.				
2.	Select suitable AM process and 3D printing technology			15	Selects the most appropriate AM process with clear justification.			Selects a suitable process with adequate justification.			Selects a process with limited justification.				
3.	Evaluate process based on quality, cost, time, accuracy, and material			10	Provides comprehensive evaluation considering all major factors and makes a decision.			Evaluates most factors and reaches a reasonable decision.			Evaluates a few factors with limited justification.				
	Total			40											

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Technical Knowledge	15	Demonstrates complete understanding of concepts	Demonstrates adequate understanding of concepts	Unclear Demonstration
2.	Presentation Skills	15	Clear, structured and confident presentation	Satisfactory presentation with minor issues	Unclear interpretation
3.	Report Quality	10	Well organized and technically accurate	Acceptable organization with moderate accuracy	Poorly structured report
	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: Purely as an Example: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26ME404	SOLAR AND WIND ENERGY		SEMESTER				IV
Prerequisites		Category	ES(PC)	Credits			3
1. Engineering Physics 2. Basic Electrical and Electronics Engineering 3. Fundamentals of Renewable Energy		Hours/ Semester	L	T	P	SL	TH
			45	0	0	45	90
COURSE OBJECTIVES							
1.	To understand solar radiation principles and various solar energy collectors.						
2.	To analyze solar thermal energy conversion and storage systems.						
3.	To study the design and performance of solar photovoltaic systems.						
4.	To understand the fundamentals and measurement techniques of wind energy systems.						
5.	To analyze aerodynamic principles and operational characteristics of wind turbines.						
UNIT - I	SOLAR RADIATION AND COLLECTORS						9
Sun angles – Sun path diagrams – Radiation – extra-terrestrial characteristics – measurement and estimation on horizontal and tilted surfaces – flat plate collector thermal analysis – testing methods – evacuated tubular collectors – concentrator collectors – classification – design and performance parameters – tracking systems – compound parabolic concentrators – parabolic trough concentrators – concentrators with point focus – Heliostats – performance of the collectors.							
UNIT - II	SOLAR THERMAL TECHNOLOGIES						9
Principle of working, types, design and operation of – Solar heating and cooling systems – Thermal Energy storage systems – Solar Desalination – Solar cooker: domestic, community – Solar Pond – Solar drying							
UNIT - III	SOLAR PV SYSTEM DESIGN AND APPLICATIONS						9
Solar cells – p-n junction – Solar cell array system analysis and performance prediction – Shadow analysis: reliability – solar cell array design concepts – PV system design – design process and optimization – detailed array design – storage autonomy – voltage regulation – maximum tracking – centralized and decentralized SPV systems – stand-alone – hybrid and grid connected system – System installation – operation and maintenance – field.							
UNIT - IV	WIND ENERGY AND WIND MEASUREMENTS						9
Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines, Atmospheric Boundary Layers, Turbulence. Instrumentation for wind measurements, Wind data analysis, tabulation, Wind resource estimation, Betz’s Limit, Turbulence Analysis.							
UNIT - V	AERODYNAMICS THEORY AND WIND TURBINE TYPES						9
Airfoil terminology, Blade element theory, Blade design, Rotor performance and dynamics, Balancing technique (Rotor & Blade), Types of loads, Sources of loads, Vertical Axis Type, Horizontal Axis, Constant Speed Constant Frequency, Variable Speed Variable Frequency, Up Wind, Down Wind, Stall Control, Pitch Control, Gear Coupled Generator type, Direct Generator Drive / PMG / Rotor Excited Synchronous Generator.							
L:45, SL:45, Total:90 Hours							
Weightage:							
Continuous Assessment 40%							
End Semester Examinations 60%							

REFERENCE BOOKS:														
1.	Chetan Singh Solanki, "Solar Photovoltaics – Fundamentals, Technologies and Applications", PHI Learning Private Limited, 2011.													
2.	Mario Garcia-Sanz and Constantine H. Houpis, "Wind Energy Systems", CRC Press, 2012.													
3.	Sukhatme S.P. and Nayak J.P., "Solar Energy – Principle of Thermal Storage and Collection", Tata McGraw Hill, 2008.													
4.	G.D. Rai, "Non-Conventional Energy Sources", Khanna publishers, 1988.													
5.	S. Rao and Dr. B.B. Parulekar, "Energy Technology: Non Conventional, Renewable and Conventional", Khanna publishers, 2013.													
E-RESOURCES:														
1.	https://nptel.ac.in/courses/108105084													
2.	https://www.energy.gov/eere/solar/solar-energy-technologies-office													
3.	https://www.iea.org/topics/renewables													
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 of solar radiation, solar thermal systems, solar photovoltaic systems, wind characteristics, and wind energy conversion systems.										PO1, PO2		PSO1	
CO2	Apply principles of solar radiation, solar thermal technologies, photovoltaic systems, and wind energy fundamentals to solve engineering problems related to renewable energy systems.										PO1, PO3		PSO1	
CO3	Analyze the performance of solar collectors, solar thermal systems, photovoltaic systems, and wind energy systems under varying environmental and operating conditions.										PO1, PO3, PO4		PSO2	
CO4	Apply and analyze wind measurements, resource assessment techniques, and system design parameters for effective utilization of solar and wind energy systems.										PO2, PO4		PSO1	
CO5	Evaluate the efficiency, performance, and suitability of solar and wind energy systems for different applications using technical and economic considerations.										PO3, PO5		PSO2	
CO6	Design and develop sustainable solar and wind energy systems for real-world applications considering environmental, societal, and operational factors.										PO6, PO7, 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	1									3		
CO2	3	1	3		1							3	1	
CO3	3	1	3	2	2							2	3	
CO4	2	3	1	2								3	1	
CO5	2	1	3	2	3						1	2	3	
CO6	1		1		1	3	3				2	1	1	3

Activities:

1.	Assignment / Seminar Presentation
2.	Case Study / Model Demonstration
3.	Quiz / Technical Report Preparation

Rubrics for evaluation: C05

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Technical Knowledge	15	Demonstrates complete understanding of concepts	Demonstrates adequate understanding of concepts	Unclear Demonstration
2.	Presentation Skills	15	Clear, structured and confident presentation	Satisfactory presentation with minor issues	Unclear interpretation
3.	Report Quality	10	Well organized and technically accurate	Acceptable organization with moderate accuracy	Poorly structured report
	Total	40			

Rubrics for evaluation: C06

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Technical Knowledge	15	Demonstrates complete understanding of concepts	Demonstrates adequate understanding of concepts	Unclear Demonstration
2.	Presentation Skills	15	Clear, structured and confident presentation	Satisfactory presentation with minor issues	Unclear interpretation
3.	Report Quality	10	Well organized and technically accurate	Acceptable organization with moderate accuracy	Poorly structured report
	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: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26ME405	MACHINE DRAWING		SEMESTER				IV
Prerequisites		Category	ES(PC)	Credits			4
Engineering Graphics		Hours/ Semester	L	T	P	SL	TH
			45	0	45	30	120
COURSE OBJECTIVES							
1.	Introduce the fundamentals of machine drawing and digital drafting techniques used in modern industries						
2.	Develop the ability to create and interpret sectional views, assembly drawings and machine components						
3.	Train students in the use of CAD tools for 2D drafting and 3D modelling applications.						
4.	Enable students to prepare professional engineering drawings with dimensions, tolerances and standard conventions.						
5.	Develop practical skills in assembly modelling, detailing and industrial drawing interpretation.						
UNIT - I	FUNDAMENTALS OF MACHINE DRAWING AND SECTIONAL VIEWS						18
Introduction to machine drawing – BIS conventions – Types of lines – Dimensioning principles – Sectioning methods – Full section – Half section – Offset section – Hatching conventions – Conventional representation of materials – Representation of threaded fasteners – Welded joints – Rivetted joints – Keys, cotters and knuckle joints.							
Practical Components:							
1. Preparation of sectional views of machine components							
2. Drawing of riveted and welded joints							
3. Representation of keys, cotters and fasteners							
4. Dimensioning practice using BIS standards							
UNIT - II	INTRODUCTION TO CAD AND 2D DRAFTING						18
CAD applications – Hardware and software requirements – CAD interface – Coordinate systems – Draw commands – Editing commands – Object selection methods – Layers – Text creation – Hatching – Dimensioning – Drafting aids – Inquiry tools – Plotting concepts.							
Practical Components:							
1. Creation of simple 2D drawings using CAD software							
2. Editing and modification exercises							
3. Layer management and dimensioning							
4. Preparation of machine component drawings using CAD tools							
UNIT - III	3D PART MODELLING OF MACHINE COMPONENTS						18
Introduction to 3D modelling – Sketcher constraints – Feature-based modelling – Extrude, revolve, sweep and loft features – Part modelling of shafts, bearings, gears, pulleys, springs, flanges and machine fasteners – Customization and toolbox applications.							
Practical Component:							
1. 3D modelling of shafts and bearings							
2. Modelling of gears, pulleys and springs							
3. Creation of standard machine fasteners							
4. Feature-based modelling exercises.							

UNIT - IV	ASSEMBLY DRAWING AND MODELLING	18
Assembly drawing principles – Bill of materials – Assembly constraints – Digital assembly modelling – Cotter joint – Knuckle joint – Screw jack – Machine vice – Plummer block – Tail stock – Shaft coupling – Stop valve – Exploded views and detailing.		
Practical Component:		
1. Assembly drawing preparation using CAD 2. Assembly modelling of machine components 3. Preparation of detailed assembly drawings with BOM 4. Exploded assembly visualization		
UNIT - V	INDUSTRIAL DRAWINGS, GD&T AND SURFACE ROUGHNESS	18
Industrial drawing interpretation – Limits, fits and tolerances – Geometric Dimensioning and Tolerancing (GD&T) – Surface roughness symbols – Industrial case studies – Reading manufacturing drawings – Engineering documentation standards – Plotting and printing standards.		
Practical Component:		
1. Study of GD&T application in engineering drawings 2. Surface roughness indication practice 3. Industrial drawing interpretation 4. Preparation and plotting of complete engineering drawings		
L:45, P:45, SL:30, Total:120 Hours		
Weightage:		
Continuous Assessment 50%		
End Semester Examinations 50%		
REFERENCE BOOKS:		
1.	N.D. Bhatt and V.M. Panchal, Machine Drawing, Charotar Publishing House.	
2.	K.R. Gopalakrishna, Machine Drawing, Subhas Publications.	
3.	K.L. Narayana, P. Kannaiah and K. Venkata Reddy, Machine Drawing, New Age International Publishers.	
4.	Sham Tickoo, AutoCAD for Engineers and Designers, CAD/CIM Technologies.	
5.	Bertoline and Wiebe, Technical Graphics Communication, McGraw Hill Education	
E-RESOURCES:		
1.	Autodesk Education Resources	
2.	NPTEL Engineering Graphics Course	
3.	SolidWorks Tutorials	
4.	AutoCAD Learning Videos	
5.	PTC Creo Learning connector	

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 machine drawing standards, sectional views and conventional representation methods used in engineering drawings.	--	
CO2	Apply CAD tools and drafting commands to create accurate 2D engineering drawings of machine components.	PO1, PO5	PSO1
CO3	Develop 3D part models of machine elements using modern CAD software and feature-based modelling techniques.	PO2, PO3, PO5	PSO2
CO4	Prepare assembly drawings and digital assembly models of mechanical systems with appropriate detailing and bill of materials.	PO3, PO5	PSO2
CO5	Analyze industrial drawings using GD&T standards, tolerances and surface roughness specifications for manufacturing applications.	PO2, PO5,	PSO3
CO6	Demonstrate self-learning and professional communication skills through industrial case studies, CAD presentations and engineering documentation.	PO9, PO10, 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				2							2		
CO3		3	3										2	
CO4			3		3								2	
CO5					3				2	3	2			3
CO6						3			3	3	2			3

Alternate Assessment Activities:

Sl. No.	Modes of Assessment Activities
1.	CAD-based Industrial Drawing Case Study (CO5)
2.	Independent Assembly Drawing / Mini Project Presentation (CO6)

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Industrial drawing interpretation	10	Drawing interpretation is completely accurate with proper GD&T understanding	Drawing interpretation is completely accurate with proper GD&T understanding	Drawing interpretation is completely accurate with proper GD&T understanding

2.	CAD analysis and detailing	10	CAD analysis and detailing are accurate and complete.	CAD analysis and detailing are accurate and complete	CAD analysis and detailing are accurate and complete
3.	Presentation of findings	10	Findings are clearly presented with technical justification	Findings are clearly presented with technical justification	Findings are clearly presented with technical justification
4.	Report presentation	10	Well-structured professional report	Well-structured professional report	Well-structured professional report
	Total	100			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	CAD model development	10	Complete and accurate CAD model with standards	Complete and accurate CAD model with standards	Complete and accurate CAD model with standards
2.	Engineering drawing standards	10	Proper dimensions, layers and annotations followed	Proper dimensions, layers and annotations followed	Proper dimensions, layers and annotations followed
3.	Independent learning and creativity	10	Innovative approach with effective selflearning	Innovative approach with effective selflearning	Innovative approach with effective selflearning
4.	Technical presentation and communication	10	Clear and professional presentation	Clear and professional presentation	Clear and professional presentation
	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: Purely as an Example: Strength = 3 (if percentage >20%);
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

26ENC03		PLACEMENT AND SOFT SKILLS LABORATORY B.E. (Common to all Branches)		SEMESTER			IV		
Prerequisites				Category	HM	Credits			2
1. Basic knowledge in reading skill and writing skill 2. Basic ability in listening skill and speaking skill				Hours/ Semester	L	T	P	SL	TH
					0	0	45	15	60
COURSE OBJECTIVES									
1.	To develop learners' overall employability communication skills in writing, speaking, verbal ability, and reasoning.								
2.	To strengthen learners' professional writing competence for letters, emails, resumes, and reports.								
3.	To enhance learners' oral communication and group interaction skills for presentations, discussions, and workplace contexts.								
4.	To build learners' soft skills, confidence, and interview readiness for successful career entry.								
5.	To improve learners' verbal and logical abilities to support effective communication and problem-solving								
UNIT - I		WRITING SKILLS							9
Letter seeking permission to go on industrial visit, Letter of invitation, Resume and cover letter, Job application, E-mail writing, Report writing - progress in project work									
UNIT - II		SPEAKING SKILLS							9
Welcome address and vote of thanks, Analysing and presenting business articles, Power point presentation, Presenting the visuals effectively, Group discussion, Participating in group discussions, Understanding group dynamics, Brain-storming the topics									
UNIT - III		SOFT SKILLS							9
Employability and career skills, Self-introduction, Introducing oneself to the audience, introducing the topic, Interview skills, Interview etiquette, Dress code, Body language, Attending job interviews									
UNIT - IV		VERBAL ABILITIES							9
Error Spotting, Listening Comprehension, Reading comprehension, Rearranging Jumbled sentences, Vocabulary									
UNIT - V		REASONING ABILITIES							9
Series completion, Analogy, Classification, Coding-Decoding, Blood relations, Seating Arrangements, Directional Sense, Venn Diagram, Logical reasoning, Statements and Conclusions									
P:45, SL:15, Total:60 Hours									
Weightage: Continuous Assessment 60% End Semester Examinations 40%									
REFERENCE BOOKS:									
1.	Pease, Allan, and Barbara Pease. The Definitive Book of Body Language. Bantam Books, 2017.								
2.	Pillai, Sabeena, and Agna Fernandez. Soft Skills and Employability Skills. Cambridge University Press, 2018.								
3.	Aggarwal, R. S. A Modern Approach to Verbal and Non-Verbal Reasoning. S. Chand Publishing, 2018.								
4.	Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press, 2016.								
5.	Thorpe, Edgar, and Showick Thorpe. Winning at Interviews. Pearson Education, 2015.								

E-RESOURCES:

1.	https://www.indiabix.com/
2.	https://www.placementpreparation.io/
3.	https://www.edx.org/
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	Apply effective writing skills to produce professional documents such as letters, resumes, cover letters, emails, and project reports.	PO9, PO11	-
CO2	Demonstrate oral communication skills by participating in presentations, group discussions, brainstorming sessions, and delivering structured talks using appropriate language and presentation techniques.	PO8, PO9, PO11	PSO3
CO3	Apply verbal ability skills to enhance language accuracy and comprehension through error spotting, vocabulary usage, reading comprehension, listening comprehension, and sentence rearrangement.	PO9, PO11	-
CO4	Solve logical and analytical problems using reasoning abilities such as series completion, analogy, classification, coding-decoding, seating arrangements, blood relations, and data interpretation.	PO9, PO11	-
CO5	Develop employability and workplace readiness skills by practicing self-introduction, interview techniques, interview etiquette, professional dress code, and body language.	PO9, PO11	-
CO6	Integrate communication, analytical, and interpersonal skills to function effectively in academic and professional environments by demonstrating overall competence in written, spoken, verbal, and reasoning tasks.	PO9, PO10, PO11	PSO3

The Course Articulation Matrix (CAM) for defined Cos

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PSO 01	PSO 02	PSO 03
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO2	-	-	-	-	-	-	-	2	3	-	2	-	-	2
CO3	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO6	-	-	-	-	-	-	-	-	3	2	2	-	-	2

Activities:

1.	CO1: Apply effective writing skills to produce professional documents such as letters, resumes, cover letters, emails, and project reports. (i) Cover Letter and Resume: Draft a resume and cover letter for a job advertisement (ii) Letter Writing: Write formal letter for an internship, industrial visit, workshop, or training programme; Write a letter to invite a chief guest, industry expert, or alumni for a college event. (iii) Email Writing: Write an email applying for an internship in a company; Send an email requesting registration for a workshop, seminar, or conference.
2.	CO2: Demonstrate oral communication skills by participating in presentations, group discussions, brainstorming sessions, and delivering structured talks using appropriate language and presentation techniques. (i) Self-Introduction: Professional self-introduction activity for placement preparation. (ii) Group Discussion: Group discussion on current social, technical, or business issues. (iii) Welcome Address, Vote of Thanks: Conduct a mock seminar where students deliver welcome addresses and vote of thanks. (iv) Power Point Presentation: Prepare and deliver a PowerPoint presentation on a technical, business, or general-interest topic using appropriate visual aids, effective slide design, and clear oral communication
3.	CO3: Apply verbal ability skills to enhance language accuracy and comprehension through error spotting, vocabulary usage, reading comprehension, listening comprehension, and sentence rearrangement. (i) Jumbled Sentences: Sentence reconstruction activity to improve coherence and logical sequencing. (ii) Reading Comprehension: Analyze newspaper articles, business reports, or technical passages and answer comprehension questions. (iii) Error Spotting: Identify and correct errors related to tenses, articles, prepositions, and subject-verb agreement.
4.	CO4: Solve logical and analytical problems using reasoning abilities such as series completion, analogy, classification, coding-decoding, seating arrangements, blood relations, and data interpretation. (i) Series Completion: Pattern recognition and numerical reasoning exercises. (ii) Analogy: Verbal and logical analogy exercises. (iii) Coding-Decoding: Coding-decoding problem-solving exercises in teams (iv) Blood Relations: Family tree analysis and relationship mapping tasks. (v) Seating Arrangements: Puzzle-solving activities involving linear and circular arrangements. (vi) Logical Reasoning: Aptitude test simulations for placement preparation.

5.	CO5: Develop employability and workplace readiness skills by practicing self-introduction, interview techniques, interview etiquette, professional dress code, and body language. (i) Self-Introduction, Job Interview: Resume-based interview practice and feedback sessions; Mock interview sessions with HR and technical rounds; Professional etiquette workshop focusing on dress code, body language, and workplace behaviour.
6.	CO6: Integrate communication, analytical, and interpersonal skills to function effectively in academic and professional environments by demonstrating overall competence in written, spoken, verbal, and reasoning tasks. (i) Placement: Campus recruitment simulation involving aptitude test, group discussion, and personal interview. (ii) Presentation of Business Article: Team-based analysis and presentation of a business or technical article. (iii) Welcome Address, Vote of Thanks: Organize and manage a mock conference or seminar, assigning roles to students. (iv) Welcome Address, Vote of Thanks: Portfolio preparation documenting written tasks, presentations, interview performance, and reasoning exercises.

Rubrics for evaluation: CO1

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Content Relevance	5	Fully relevant content	Mostly relevant content	Limited relevance
2.	Organization and Format	5	Well-organized and correctly formatted	Minor organizational errors	Poor organization and format
3.	Professional Tone	5	Appropriate professional tone	Generally appropriate tone	Inappropriate tone
4.	Language Accuracy	5	Error-free language	Minor language errors	Frequent language errors
	Total	20			

Rubrics for evaluation: CO2

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Clarity and Fluency	5	Clear and fluent speech	Minor hesitation	Frequent hesitation
2.	Content Organization	5	Well-structured presentation	Adequately organized	Poorly organized
3.	Presentation Skills	5	Excellent delivery and engagement	Adequate delivery	Limited engagement
4.	Body Language	5	Excellent posture, eye contact, and gestures	Adequate non-verbal communication	Poor posture and limited eye contact
	Total	20			

Rubrics for evaluation: CO3

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Comprehension	5	Excellent understanding	Good understanding	Limited understanding
2.	Language Accuracy	5	Accurate error identification	Minor inaccuracies	Frequent inaccuracies
3.	Vocabulary Usage	5	Appropriate vocabulary usage	Adequate vocabulary usage	Limited vocabulary usage
4.	Logical Sequencing	5	Highly logical sequencing	Generally logical	Poor sequencing
	Total	20			

Rubrics for evaluation: CO4

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Problem Analysis	5	Accurate problem analysis	Good analysis	Limited analysis
2.	Logical Reasoning	5	Strong reasoning ability	Adequate reasoning ability	Weak reasoning ability
3.	Accuracy	5	Highly accurate solutions	Adequate vocabulary usage	Limited vocabulary usage
4.	Time Management	5	Completes within time	Minor delay	Significant delay
	Total	20			

Rubrics for evaluation: CO5

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Professional Etiquette	2.5	Highly professional behaviour	Generally professional	Limited professionalism
2.	Interview Skills	2.5	Confident and effective responses	Adequate responses	Weak responses
3.	Body Language	2.5	Excellent body language	Adequate body language	Poor body language
4.	Workplace Readiness	2.5	Highly workplace-ready	Reasonably prepared	Needs improvement
	Total	10			

Rubrics for evaluation: CO6

Sl. No.	Criterion	Marks	Excellent (3)	Good (2)	Satisfactory (1)
1.	Communication Skills	2.5	Highly effective communication	Effective communication	Limited effectiveness
2.	Analytical Skills	2.5	Strong analytical ability	Adequate analytical ability	Weak reasoning ability
3.	Teamwork Skills	2.5	Excellent teamwork and leadership	Good teamwork	Limited teamwork
4.	Professional Competence	2.5	Demonstrates overall competence	Demonstrates adequate competence	Requires improvement
	Total	10			

The Internal Assessment Matrix (IAM) for the defined COs:				
CO	Evaluation of Student Work, Observation of Record and Model Test	Activity	Percentage allocation	Mapping Strength
C01	20	20	20	2
C02	20	20	20	2
C03	20	20	20	2
C04	20	20	20	2
C05	10	10	10	2
C06	10	10	10	2
Total	100	100	100	
Note: Purely as an Example: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);				

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

UNIT - IV		Harmony in Nature and Existence		9
Understanding Harmony in the Nature and Existence - Whole existence as Coexistence. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space. Holistic perception of harmony at all levels of existence.				
UNIT - V		Professional Ethics and Universal Human Order		9
Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics, Strategy for transition from the present state to Universal Human Order.				
L:45, SL:45, Total:90 Hours				
Weightage:				
Continuous Assessment: 40%				
End Semester Examinations: 60%				
REFERENCE BOOKS:				
1.	"Human Values and Professional Ethics", R R Gaur., R Sangal., G P Bagaria, Excel Books, New Delhi, 2010			
2.	"Human Values", A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.			
3.	"The Story of Stuff"., Annie Leonard, 2007 documentary.			
4.	"The Story of My Experiments with Truth"., Mohandas Karamchand Gandhi			
5.	"Small is Beautiful" - E. F Schumacher.			
E-RESOURCES:				
1.	AICTE, "Universal Human Values," All India Council for Technical Education, https://www.aicte.gov.in/bureaus/universal-human-values-cell			
2.	UHV Foundation, "Universal Human Values and Professional Ethics," https://uhv.org.in			
3.	Value Education Cell, "Universal Human Values Resources," https://fdp-si.aicte-india.org			
4.	SWAYAM, "Human Values and Professional Ethics," Ministry of Education, Government of India, https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg125			
COURSE OUTCOMES (COs) / At the end of the course, the students will have the ability to			Mapping POs	Mapping PSOs
CO1	Learners will be able to 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	Learners will be able to 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	Learners will be able to 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	Learners will be able to 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	Learners will be able to evaluate harmony in nature and existence by understanding interconnectedness, mutual fulfilment, recyclability, self-regulation, and holistic perception of coexistence at all levels.	PO6	-
CO6	Learners will be able to apply 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:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1														
CO2						2								
CO3							2							
CO4								1						
CO5						3								
CO6											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, interconnectedness, and mutual fulfilment in nature	Explains the concept with minor gaps	Shows limited understanding
2.	Reflection on coexistence	10	Provides meaningful reflection on coexistence, recyclability, and self-regulation	Reflection is relevant but needs more depth	Reflection is basic or unclear
3.	Practical relevance	10	Relates harmony in nature to sustainable living and human responsibility effectively	Relates the concept with limited examples	Practical relevance is weak
4.	Presentation of assignment	10	Assignment is well-organized, clear, and neatly presented	Assignment is organized but needs improvement	Assignment is incomplete or poorly presented
	Total	40			

Rubrics for evaluation: CO6

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

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

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

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

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			