PANIMALAR
ENGINEERING COLLEGE

An Autonomous Institution

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

CURRICULUM & SYLLABUS

REGULATION 2023

FOR THE STUDENTS ADMITTED DURING 2023-24

B.E - MECHANICAL ENGINEERING

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PANIMALAR ENGINEERING COLLEGE
(An Autonomous Institution, Affiliated to Anna University, Chennai)
Bangalore Trunk Road, Varadharajapuram,
Poonamallee, Chennai – 600 123

Department of Mechanical Engineering
B.E- Mechanical Engineering

CURRICULUM AND SYLLABUS
REGULATION-2023
(Students admitted 2023-24 onwards)

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

1. Graduates will contribute to the industrial and societal needs as per the recent developments using knowledge acquired through basic engineering education and training.
2. Graduates will be able to demonstrate technical knowledge and skills in their career with systems perspective, analyze, design, develop, optimize, and implement complex mechanical systems.
3. Graduates will be able to work in multidisciplinary environment developing complex mechanical systems.
4. Graduates will work as a team or as an individual with utmost commitment towards the completion of assigned task using apt communication, technical and management skills.
5. Graduate will recognize the importance of professional development by pursuing higher studies in various specializations.

PROGRAM OUTCOMES (PO)

PO1 (Engineering knowledge): Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 (Problem Analysis): Identify, formulate, research literature, and analyze complex engineering problem reaching substantiated conclusions using first principles of mathematics,natural sciences, and engineering sciences.

PO3(Design/development of solutions): Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 (Conduct investigations of complex problems): Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5(Modern tool usage): Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6(The engineer and society): Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice.

PO7 (Environment and sustainability): Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 (Ethics): Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9 (Individual and team work): Function effectively as an individual, and as a memberor leader in diverse teams, and in multidisciplinary settings

PO10(Communication): Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 (Project management and finance): Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 (Life-long learning): Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1: Fundamental Domain Knowledge: Design mechanical systems in various fields of machine elements, thermal, manufacturing, industrial and inter disciplinary fields using engineering/technological tools

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PSO 2: Usage of software programs: Resolve new challenges in Mechanical Engineering using modern computer tools and software programs.

PSO 3: **Continual learning and Research:** Develop intellectual and technical solution to complex mechanical problems through continual learning and research.

B.E.- MECHANICAL ENGINEERING

CHOICE BASED CREDIT SYSTEM (CBCS)

I - VIII SEMESTERS CURRICULUM AND SYLLABI (REGULATION 2023)

(For the Students admitted during 2023-24)

Semester I							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23MA1101	Matrices and Calculus	BS	3/1/0	4	4	60/40
2.	23ES1101	Problem solving using C Programming	ES	3/0/0	3	3	60/40
3.	23ES1103	Engineering Graphics	ES	2/0/2	4	3	60/40
Theory Cum Practical Courses							
4.	23HS1101	Communicative English and Language Skills	HS	2/0/2	4	3	50/50
5.	23PH1101	Engineering Physics	BS	2/0/2	4	3	50/50
Laboratory Courses							
6.	23ES1111	Problem solving using C Programming Laboratory	ES	0/0/4	4	2	40/60
Mandatory Course							
7.	23TA1101	தமிழர் மரபு / Heritage of Tamils	HS	1/0/0	1	1	60/40
			TOTAL		**24**	**19**	

Semester II							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23MA1202	Complex Variables and Numerical Methods	BS	3/1/0	4	4	60/40
2.	23ME1201	Engineering Mechanics	PC	3/0/0	3	3	60/40
3.	23ES1205	Basic Electrical Engineering	ES	3/0/0	3	3	60/40
Theory Cum Practical Courses							
4.	23HS1201	Communicative and Aptitude Skills	HS	2/0/2	4	3	50/50
5.	23ES1203	Fundamentals of Python programming	ES	2/0/2	4	3	50/50
Laboratory Courses							
6.	23ES1212	Technical Skills Practices -I	EEC	0/0/2	2	1	40/60
7.	23ES1213	Product Development Laboratory	ES	0/0/4	4	2	40/60
8.	23ES1214	Electrical Engineering Laboratory	ES	0/0/4	4	2	40/60
Mandatory Course							
9.	23TA1201	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1/0/0	1	1	60/40
10.		Mandatory Course I	MC	2/0/0	2	0	0/100
			TOTAL		**31**	**22**	

Semester III							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23MA1303	Transforms and Partial Differential Equations	BS	3/1/0	4	4	60/40
2.	23ME1301	Strength of Materials	PC	3/0/0	3	3	60/40
3.	23ME1302	Manufacturing Processes	PC	3/0/0	3	3	60/40
4.	23ME1303	Engineering Thermodynamics	PC	3/0/0	3	3	60/40
5.	23ME1304	Engineering Materials and Metallurgy	PC	3/0/0	3	3	60/40
6.	23ME1305	Fluid Mechanics and Machinery	PC	3/0/0	3	3	60/40
Laboratory Courses							
7.	23ME1311	Manufacturing Processes Laboratory	PC	0/0/4	4	2	40/60
8.	23ME1312	Strength of Materials and Fluid Mechanics Laboratory	PC	0/0/4	4	2	40/60
			TOTAL		**27**	**23**	

Semester IV							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23MA1404	Probability and Statistics	BS	3/1/0	4	4	60/40
2.	23ME1401	Kinematics of Machinery	PC	3/0/0	3	3	60/40
3.	23ME1402	Thermal Engineering	PC	3/0/0	3	3	60/40
4.	23ME1403	Metal Cutting and Machine Tools	PC	3/0/0	3	3	60/40
5.	23ML1401	Introduction to Artificial Intelligence for Mechanical Engineering	PC	3/0/0	3	3	60/40
Laboratory Courses							
6.	23ME1411	Metal Cutting and Machine Tools Laboratory	PC	0/0/4	4	2	40/60
7.	23ME1412	Computer Aided Design Laboratory	PC	0/0/4	4	2	40/60
8.	23ME1413	Heat Engines Laboratory	PC	0/0/4	4	2	40/60
Mandatory Course							
9.		Mandatory Course -II	MC	2/0/0	2	0	0/100
			TOTAL		**30**	**22**	

Semester V							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23ME1501	Design of Machine Elements	PC	3/0/0	3	3	60/40
2.	23ME1502	Metrology and Measurements	PC	3/0/0	3	3	60/40
3.	23ME1503	Heat And Mass Transfer	PC	3/0/0	3	3	60/40
4.	23ME1504	Dynamics of Machines	PC	3/0/0	3	3	60/40
5.	23ME1505	Fundamental of Data Science for Mechanical Engineering	PC	3/0/0	3	3	60/40
6.		Professional Elective - I	PE	3/0/0	3	3	60/40
Laboratory Courses							
7.	23ME1511	Metrology and Dynamics Laboratory	PC	0/0/4	4	2	40/60
8.	23ME1512	Thermal Engineering Laboratory	PC	0/0/4	4	2	40/60
			TOTAL		**26**	**22**	

Semester VI							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23ME1601	Design of Transmission Systems	PC	3/0/0	3	3	60/40
2.	23ME1602	Finite Element Analysis	PC	3/0/0	3	3	60/40
3.	23ME1603	CAD CAM and CIM	PC	3/0/0	3	3	60/40
4.	23ME1604	Hybrid and Electric Vehicles	PC	3/0/0	3	3	60/40
5.		Professional Elective - II	PE	3/0/0	3	3	60/40
6.		Professional Elective - III	PE	3/0/0	3	3	60/40
Laboratory Courses							
7.	23ME1611	Computer Aided Manufacturing Laboratory	PC	0/0/4	4	2	40/60
8.	23ME1612	Design and Fabrication Project	EEC	0/0/4	4	2	40/60
			TOTAL		**26**	**22**	

Semester VII							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23ME1701	Industrial Engineering	PC	3/0/0	3	3	60/40
2.	23ME1702	Mechatronics	PC	3/0/0	3	3	60/40
3.		Open Elective - I	OE	3/0/0	3	3	60/40
4.		Professional Elective - IV	PE	3/0/0	3	3	60/40
5.		Professional Elective - V	PE	3/0/0	3	3	60/40
6.		Professional Elective - VII	PE	3/0/0	3	3	60/40
Laboratory Courses							
7.	23ME1711	Mechatronics Laboratory	PC	0/0/4	4	2	40/60
8.	23ME1712	Simulation And Analysis Laboratory	PC	0/0/4	4	2	40/60
9.	23ME1713	Identification of Project Work	EEC	0/0/4	4	2	40/60
			TOTAL		**30**	**24**	

Semester VIII							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.		Open Elective - II	OE	3/0/0	3	3	60/40
2.		Professional Elective - VII	PE	3/0/0	3	3	60/40
Laboratory Courses							
3.	23ME1811	Project Work	EEC	0/0/16	16	8	60/40
			TOTAL		**22**	**14**	

Total Number of Credits: 168

Professional Elective courses-Vertical

Vertical 1	Vertical 2	Vertical 3	Vertical 4	Vertical 5	Vertical 6	Vertical 7
Design	**Robotics And Automation**	**Thermal Sciences**	**Modern Mobility Systems**	**Industrial Management**	**Logistics And Supply Chain Management**	**Diversified Group**
Surface Engineering and Tribology	Welding Technology	Renewable Energy Resources	Advanced IC Engines	Engineering Ethics	Operations Research	Thermal Power Engineering
Optimization Techniques in Engineering	Modern Machining Processes	Energy conservation and waste heat recovery	Automotive Technology	Production Planning and Control	Automation in Manufacturing	Selection of Materials
Design of Jigs & Fixtures	Hydraulics and Pneumatics	Nuclear Engineering	Automotive Electrical and Electronics	Total Quality Management	Warehousing Automation	Internet of Things for Mechanical Engineers
Composite Materials and Mechanics	Additive Manufacturing	Turbo Machinery Systems	Vehicle Body Engineering	Process Planning and Cost Estimation	Material Handling Equipment, Repair and Maintenance	Machine Vision
Testing of Materials	Automation in Manufacturing	Gas Dynamics and Jet Propulsion	Vehicle Dynamics	Industrial safety & Maintenance	Plant Layout Design and Ergonomics	Advanced Vehicle Engineering
Design concepts in Engineering	Digital Manufacturing	Solar Energy Engineering	Vehicle Maintenance & Safety	Entrepreneurship Development	Logistics in Manufacturing, Supply Chain and Distribution	Non Destructive Testing and Evaluation
Noise, vibration and Harshness	Industrial Robotics	Refrigeration and Air Conditioning	Thermal Management of Batteries and Fuel Cells	Quality and Reliability Engineering	Supply chain Management	
New Product Development	Nano Technology	Computational Fluid Dynamics				

PROFESSIONAL ELECTIVES

Vertical 1 **Area of Specialization: Design**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ME1901	Surface Engineering and Tribology	PE	3	3	0	0	3
2.	23ME1902	Optimization Techniques in Engineering	PE	3	3	0	0	3
3.	23ME1903	Design of Jigs & Fixtures	PE	3	3	0	0	3
4.	23ME1904	Composite Materials and Mechanics	PE	3	3	0	0	3
5.	23ME1905	Testing of Materials	PE	3	3	0	0	3
6.	23ME1906	Design concepts in Engineering	PE	3	3	0	0	3
7.	23ME1907	Noise, vibration and Harshness	PE	3	3	0	0	3
8.	23ME1908	New Product Development	PE	3	3	0	0	3

Vertical 2 **Area of Specialization: Robotics and Automation**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ME1909	Welding Technology	PE	3	3	0	0	3
2.	23ME1910	Modern Machining Processes	PE	3	3	0	0	3
3.	23ME1911	Hydraulics and Pneumatics	PE	3	3	0	0	3
4.	23ME1912	Additive Manufacturing	PE	3	3	0	0	3
5.	23ME1913	Automation in Manufacturing	PE	3	3	0	0	3
6.	23ME1914	Digital Manufacturing	PE	3	3	0	0	3
7.	23ME1915	Industrial Robotics	PE	3	3	0	0	3
8.	23ME1916	Nano Technology	PE	3	3	0	0	3

Vertical 3 **Area of Specialization: Thermal Sciences**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ME1917	Renewable Energy Resources	PE	3	3	0	0	3
2.	23ME1918	Energy conservation and waste heat recovery	PE	3	3	0	0	3
3.	23ME1919	Nuclear Engineering	PE	3	3	0	0	3
4.	23ME1920	Turbo Machinery Systems	PE	3	3	0	0	3
5.	23ME1921	Gas Dynamics and Jet Propulsion	PE	3	3	0	0	3
6.	23ME1922	Solar Energy Engineering	PE	3	3	0	0	3
7.	23ME1923	Refrigeration and Air Conditioning	PE	3	3	0	0	3
8.	23ME1924	Computational Fluid Dynamics	PE	3	3	0	0	3

Vertical 4 **Area of Specialization: Modern Mobility Systems**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ME1925	Advanced IC Engines	PE	3	3	0	0	3
2.	23ME1926	Automotive Technology	PE	3	3	0	0	3
3.	23ME1927	Automotive Electrical and Electronics	PE	3	3	0	0	3
4.	23ME1928	Vehicle Body Engineering	PE	3	3	0	0	3
5.	23ME1929	Vehicle Dynamics	PE	3	3	0	0	3
6.	23ME1930	Vehicle Maintenance and Safety	PE	3	3	0	0	3
7.	23ME1931	Thermal Management of Batteries and Fuel	PE	3	3	0	0	3

Vertical 5 Area of Specialization: Industrial Management

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ME1932	Engineering Ethics	PE	3	3	0	0	3
2.	23ME1933	Industrial Engineering	PE	3	3	0	0	3
3.	23ME1934	Total Quality Management	PE	3	3	0	0	3
4.	23ME1935	Production Planning and Control	PE	3	3	0	0	3
5.	23ME1936	Industrial safety and Maintenance	PE	3	3	0	0	3
6.	23ME1937	Entrepreneurship Development	PE	3	3	0	0	3
7.	23ME1938	Quality and Reliability Engineering	PE	3	3	0	0	3

Vertical 6 Area of Specialization: Logistics and Supply Chain Management

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ME1939	Operations Research	PE	3	3	0	0	3
2.	23ME1940	Automation in Manufacturing	PE	3	3	0	0	3
3.	23ME1941	Warehousing Automation	PE	3	3	0	0	3
4.	23ME1942	Material Handling Equipment, Repair and Maintenance	PE	3	3	0	0	3
5.	23ME1943	Plant Layout Design and Ergonomics	PE	3	3	0	0	3
6.	23ME1944	Logistics in Manufacturing, Supply Chain and Distribution	PE	3	3	0	0	3
7.	23ME1945	Supply Chain Management	PE	3	3	0	0	3

Vertical 7 **Area of Specialization: Diversified Group**

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ME1946	Thermal Power Engineering	PE	3	3	0	0	3
2.	23ME1947	Selection of Materials	PE	3	3	0	0	3
3.	23ME1948	Internet of Things for Mechanical Engineers	PE	3	3	0	0	3
4.	23ME1949	Machine Vision	PE	3	3	0	0	3
5.	23ME1950	Advanced Vehicle Engineering	PE	3	3	0	0	3
6.	23ME1951	Non Destructive Testing and Evaluation	PE	3	3	0	0	3

OPEN ELECTIVES

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23GE1001	Disaster Management	OE	3	3	0	0	3
2.	23GE1006	Intellectual Property Rights	OE	3	3	0	0	3
3.	23ME1001	Energy Auditing	OE	3	3	0	0	3
4.	23ME1002	Lean Six Sigma	OE	3	3	0	0	3
5.	23ME1003	Sensors for Automation	OE	3	3	0	0	3
6.	23ME1004	Industrial Pollution and Prevention	OE	3	3	0	0	3
7.	23ME1005	Hospital Management	OE	3	3	0	0	3
8.	23ME1006	Systems Engineering	OE	3	3	0	0	3
9.	23ME1007	Marketing Management	OE	3	3	0	0	3
10.	23CS1003	Cloud computing	OE	3	3	0	0	3
11.	23EE1004	Micro Electro Mechanical Systems	OE	3	3	0	0	3

EMPLOYMENT ENHANCEMENT COURSES (EEC)

S. No	Course Code	Course Title	Credits	Category	
1.	23ME1613	Design and Fabrication Project	2	EEC	VI
2.	23ME1713	Identification Of Project Work	2	EEC	VII
3.	23ME1811	Project Work	8	EEC	VIII

VALUE ADDED COURSE

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23VAC01	Computer Aided Design using CATIA V5	VAC	30	0	0	2	0
2.	23VAC02	Hypermesh	VAC	30	0	0	2	0
3.	23VAC03	Industrial Automation	VAC	30	0	0	2	0
4.	23VAC04	MAT LAB & Control Concepts	VAC	30	0	0	2	0

CREDIT DISTRIBUTION

S.No.	Subject Area	Credits Per Semester								Credits Total	Percentage
	Semester	I	II	III	IV	V	VI	VII	VIII		
1.	Humanities and Social Studies (HS)	4	4	-	-	-	-	-	-	8	4.76
2.	Basic Sciences (BS)	7	4	4	4	-	-	-	-	19	11.31
3.	Engineering Sciences(ES)	8	10	-	-	-	-	-	-	18	10.71
4.	Professional Core (PC)	-	3	19	18	19	14	10		83	49.40
5.	Professional Electives (PE)	-	-	-	-	3	6	9	3	21	12.50
6.	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3.57
7.	Project Work (PR/EEC)	-	1	-	-	-	2	2	8	13	7.74
8.	Non-Credit/ (Mandatory)	-	0	-	0	-	-	-	-	0	0
	Total	**19**	**22**	**23**	**22**	**22**	**22**	**24**	**14**	**168**	**100**

SEMESTER – I

23MA1101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE

- To comprehend matrices as mathematical structures used to represent data, equations, and transformations in various engineering applications.
- To introduce the concepts of limits, continuity, derivatives and maxima and Minima.
- To familiarize the functions of two variables and finding its extreme points.
- To provide understanding of various techniques of integration.
- To introduce integral ideas in solving areas, volumes and other practical problems.

UNIT I MATRICES 9+3

Eigen values and Eigenvectors of a real matrix - Characteristic equation -Properties of Eigen values and Eigenvectors -Cayley Hamilton theorem -Diagonalization of matrices- Reduction of a quadratic form to canonical form by orthogonal transformation - Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 9+3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (Sum, Product & Quotient rule, Chain rule, logarithmic and implicit differentiation) - Maxima and Minima of functions of one variable and its applications**.**

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial differentiation - Total derivative - Change of variables –Jacobian's- Taylor's series for functions of two variables - Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS 9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts -Bernoulli's formula- Integration of rational functions by partial fraction - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS 9+3

Doubleintegrals in Cartesian and polar coordinates - Change of order of integration in Cartesian coordinates - Area enclosed by plane curves - Change of variables in double integrals -Triple integrals - Volume of Solids.

TOTAL :60 PERIODS

COURSE OUTCOME

Upon successful completion of the course, students will be able to:

CO1 Able to apply matrix operations to solve engineering problems efficiently.
CO2 Apply limit definition and rules of differentiation to differentiate functions.
CO3 Understand familiarity in the knowledge of Maxima and Minima, Jacobian,Taylor series and apply the problems involving Science and Engineering.
CO4 Understand the knowledge of Integration by parts, Integration of rational functions by partial fraction.
CO5 Understand the knowledge of Area enclosed by plane curves, Change of variables in double integrals, Triple integrals, Volume of Solids.

TEXT BOOKS

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, NewDelhi,44rdEdition,2018.
2. James Stewart, "Calculus: Early Transcendental", Cengage Learning,9thEdition,NewDelhi,2015.
3. Bali N., Goyal M. and Walkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.,), New Delhi, 7th Edition, 2015.

REFERENCE BOOKS

1. Narayanan, S. and Manicavachagam Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt.Ltd.Chennai, 2007.
2. Srimanta Pal and Bhunia,S.C, "Engineering Mathematics" Oxford University Press,2015.
3. B.V. Ramana “Higher Engineering Mathematics”, McGraw Hill Education, India.
4. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley sons, 10th Edition,2015.
5. Sivaramakrishna Dass, C. Vijayakumari, “Engineering Mathematics”, Pearson Education India, 4th Edition 2019.
6. Sundar Raj. M and Nagarajan. G , “Engineering Mathematics-I”,3rd Edition, Sree Kamalamani Publications, Chennai, 2020.

ONLINE COURSES / RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_ma60/preview
2. https://onlinecourses.nptel.ac.in/noc21_ma58/preview

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**									**1**
CO2	**3**	**3**	**3**									**1**
CO3	**3**	**3**	**3**									**1**
CO4	**3**	**3**	**3**									**1**
CO5	**3**	**3**	**3**									**1**

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ES1101	PROBLEM SOLVING USING C PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To learn the syntax for C programming
- To develop C Programs using basic programming constructs
- To develop C Programs using arrays and strings
- To develop applications in C using functions, pointers
- To develop applications using structures and union

UNIT-I BASICSOFCPROGRAMMING 9

Introduction to programming paradigms – Algorithms – Flowchart - Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Type Conversion Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Format specifiers, Assignment statements – Decision making statements - Switch statement – Break – Continue - Goto statement - Looping statements – Pre-processor directives - Compilation process.

UNIT-II ARRAYSANDSTRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode - Two dimensional arrays – Example Program: Matrix Operations (Addition, Multiplication, Determinant and Transpose) – String operations: length, compare, concatenate, copy, Reverse and Palindrome – Selection sort, Insertion sort - linear and binary search.

UNIT-III FUNCTIONSANDPOINTERS 9

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

UNIT-IV STRUCTURES ANDUNION 9

Structure - Nested structures– Pointer and Structures– Array of structures – Example Program using structures and pointers – Self-referentials structures – Dynamic memory allocation – Singly linked list– typedef and Union.

UNIT-V FILEPROCESSING 9

Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files– Command line arguments.

TOTAL:45PERIODS

COURSE OUTCOME

On successful completion of the course student will be able to:

CO1 Learn the syntax for C programming.
CO2 Develop simple applications in C using basic constructs.
CO3 Design and implement applications using arrays and strings.
CO4 Develop and implement applications in C using functions and pointers.
CO5 Develop applications in C using structures and union.
CO6 Design applications using sequential and random access file processing.

TEXT BOOKS

1. Reema Thareja, —Programming in C, Oxford University Press, Second Edition,2016.
2. Kernighan, B.W and Ritchie,D.M, —The C Programming language, Second Edition, Pearson Education, 2006.

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, — C How to Program, Seventh edition, Pearson Publication, 2015.
2. Juneja, B. L and Anita Seth, —Programming in C, CENGAGE Learning India pvt. Ltd., 2011.
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schism"s Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.

WEBREFERENCES

1. https://github.com/tscheffl/ThinkC/blob/master/PDF/Think-C.pdf
2. https://freecomputerbooks.com/langCBooks.html

ONLINECOURSES/ RESOURCES

1. https://www.programiz.com/c-programming
2. https://www.tutorialspoint.com/cprogramming/index.htm
3. https://www.javatpoint.com/c-programming-language-tutorial
4. https://www.geeksforgeeks.org/c-programming-language/

5. https://en.wikibooks.org/wiki/C_Programming
6. https://www.cprogramming.com/tutorial/c-tutorial.html?inl=hp

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1		1						
CO2	2	1	1	1	2	1						
CO3	3	2	2	1	3	1						
CO4	3	2	2	1	3	1						
CO5	2	1	1	1	2	1						
CO6	2	1	1	1	2	1						

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23ES1103	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVE

- Drawing Engineering curves.
- Drawing orthographic projections of lines and planes.
- Drawing orthographic projections of solids.
- Drawing section and development of the surfaces of objects.
- Drawing isometric views and intersection curves of simple solids.
- Drawing free hand sketches of basic geometrical shapes, multiple views of objects and Applications of Engineering Graphics.

UNIT 0 CONCEPTS AND CONVENTIONS (Not for Examination) 2

Importance of drawing in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning - Introduction to Scales - Geometric construction - to draw perpendiculars, parallel lines, divide a line and circle, to draw equilateral triangle, square, regular polygons. Introduction to drafting packages like CAD and demonstration of their use in engineering fields.

UNIT I ENGINEERING CURVES AND PROJECTION OF POINTS AND LINES 6+6

Basic construction of cycloid, epicycloid and hypocycloid - Drawing of tangents and normal to the above curves. Construction of involutes of square, pentagon and circle - Drawing of tangents and normal to the above involutes.

Orthographic projection – Introduction to Principal Planes of projections - First angle projection - Projection of points. Projections of straight lines (only in First angle projections) inclined to both the principal planes - Determination of true lengths, true inclinations and traces by rotating line method

UNIT II PROJECTIONS OF PLANES AND PROJECTIONS OF SOLIDS 6+6

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method and auxiliary plane method.

Projection of simple solids like prisms, pyramids, cylinder, and cone when the axis is inclined to one principle planes by rotating object method.

UNIT III SECTIONS of SOLIDS AND DEVELOPMENT OF SURFACES 6+6

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.

Development of lateral surfaces of simple solids and frustum and truncated solids – Prisms, pyramids cylinders and cones.

UNIT IV INTERSECTION OF SOLIDS AND ISOMETRIC PROJECTIONS 6+6

Line of intersection - Determining the line of intersection between surfaces of two interpenetrating two square prisms and Intersection of two cylinders with axes of the solids intersecting each other perpendicularly, using line method.

Principles of isometric projection – isometric scale –Isometric projections and isometric views of simple solids and frustum and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions.

UNIT V FREE-HAND SKETCHING 5+5

Steps in free hand sketching - Orthographic views (front, top and side views) of simple blocks from their Isometric view, Isometric view of simple blocks from their Orthographic views (front, top and side views)

TOTAL : 60 PERIODS

COURSE OUTCOME

Upon successful completion of the course, students will be able to:

CO1 Draw the engineering curves and draw orthographic projections of lines and planes

CO2 Draw orthographic projections of planes and solids

CO3 Draw the sections and development of the surfaces of objects

CO4 Draw isometric projections and intersection of curves of simple solids.

CO5 Draw free hand sketching of basic geometrical shapes, multiple views of objects

TEXT BOOKS

1. Natarajan, K. V., “A text book of Engineering Graphics”, 28th Ed., Dhanalakshmi Publishers, Chennai, 2015.
2. Venugopal, K. and Prabhu Raja, V., “Engineering Graphics”, New Age Publications,2008.

REFERENCE BOOKS

1. Bhatt, N.D.,Panchal V M and Pramod R. Ingle, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015
3. Agrawal, B. and Agrawal C.M., “Engineering Drawing”, Tata McGraw, N.Delhi, 2008.

WEB REFERENCES

1. https://nptel.ac.in/courses/105/104/105104148/
2. https://www.youtube.com/channel/UCkCk0nvNyWhEOLge9JtDLDg

ONLINE COURSES / RESOURCES

1. https://nptel.ac.in/courses/112/103/112103019/

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**								**3**	**3**
CO2	**3**	**3**	**3**								**3**	**3**
CO3	**3**	**3**	**3**								**3**	**3**
CO4	**3**	**3**	**3**								**3**	**3**
CO5	**3**	**3**	**3**								**3**	**3**

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23HS1101	COMMUNICATIVE ENGLISH AND LANGUAGE SKILLS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVE

- To induce the basic reading and writing skills among the first year engineering and technology students.
- To assist the learners to develop their listening skills, which will enable them listening to lectures and comprehend them by asking questions and seeking clarifications.
- To succour the learners to develop their speaking skills and speak fluently in real contexts.
- To motivate the learners to develop vocabulary of a general kind by developing their reading skills for meeting the competitive exams like GATE, TOFEL, GRE, IELTS, and other exams conducted by Central and State governments.
- To learn to use basic grammatical structures in suitable contexts

UNIT I INFORMAL COMMUNICATION 6

Listening: Listening and filling details, Listening to Speeches by Specialists and Completing Activities such as Answering Questions, Identifying the Main Ideas, Style, etc. **Speaking**: Introducing One-self – Introducing a Friend/ Family. **Reading**: Descriptive Passages (From Newspapers / Magazines).**Writing**: Autobiographical Writing, Developing Hints. **Grammar**: Noun, Pronoun & Adjective. **Vocabulary Development**: One Word Substitution.

UNIT II CONVERSATIONAL PRACTICE 6

Listening: Listening to Conversations (Asking for and Giving Directions).**Speaking**: Making Conversation Using (Asking for Directions, Making an Enquiry), Role Plays, and Dialogues. **Reading**: Reading a Print Interview and Answering Comprehension Questions. **Writing**: Writing a Checklist, Dialogue Writing **Grammar**: Tenses and Voices, Regular and Irregular Verbs. **Vocabulary Development**: Prefix &Suffix, Word formation.

UNIT III OFFICIAL COMMUNICATIONS 6

Listening: Listening for specific information. Speaking: Giving Short Talks on a given Topic. **Reading**: Reading Motivational Essays on Famous Engineers and Technologists (Answering Open-Ended and Closed Questions).**Writing**: Writing Permission Letters/Editor, Complaint, and Invitation. Emails and Review Writing-Books, Films. **Grammar**: Adverb, Prepositions & Conjunctions. **Vocabulary Development**: Collocations – Fixed Expressions.

UNIT IV COMMUNICATION AT WORK PLACE 6

Listening: Listening to Short Talks (5 Minutes Duration and Fill a Table, Gap-Filling Exercise) Note Taking/Note Making .**Speaking**: Small Group Discussion, Giving Recommendations. **Reading**: Reading Problem – Solution Articles/Essays Drawn From Various Sources .**Writing**: Making Recommendations. **Grammar**: Subject-Verb Agreement, Framing Questions. **Vocabulary Development**: Infinitives and Gerunds, Reference Words, Technical Vocabulary.

UNIT V DEFINITIONS AND PRODUCT DESCRIPTION 6

Listening: Listening to a Product Description (Labelling and Gap Filling) Exercises. **Speaking**: Describing a Product and Comparing and Contrasting it with Other Products. **Reading**: Reading Graphical Material for Comparison (Advertisements).**Writing**: Essay Writing. Compare and Contrast Paragraphs, Essay writing. **Grammar**: Phrasal Verbs – Cause and Effect Sentences –Compound Nouns and Definitions. **Vocabulary Development:** Use of Discourse Markers.

TOTAL : 30 PERIODS

COURSE OUTCOME

Upon successful completion of the course, students will be able to:

- **CO1** The students will be able to comprehend conversation and short talks delivered in English.
- **CO2** Participate effectively in informal conversation; introduce themselves and their friends and express opinions English.
- **CO3** Read articles of a general kind in magazines and newspaper.
- **CO4** Write short essays of a general kind and personal letters and emails in English.
- **CO5** To gain understanding of basic grammatical structures and use them in right context.
- **CO6** To use appropriate words in a professional context.

TEXT BOOKS

1. N P Sudharshana& C Savitha. English for Technical Communication Delhi: CUP, 2019.
2. Board of Editors. English for Engineers and Technologists Volume 1 Orient Black Swan Limited, 2020

REFERENCE BOOKS

1. Board of Editors. Using English-A course book for Undergraduate engineers and Technologists Orient Black Swan Limited, 2017
2. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
3. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011 3. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning ,USA:2007
4. Redston, Chris &Gillies Cunningham Face2Face (Pre-intermediate Student's Book &Workbook)Cambridge University Press, New Delhi: 2005.

WEB REFERENCES

1. https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary-exams/wordformation
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/20180316 21.pdf
3. http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm
4. https://www.edudose.com/english/grammar-degree-of-comparison-rules/

ONLINE COURSES / RESOURCES

1. https://basicenglishspeaking.com/wh-questions/
2. https://agendaweb.org/verbs/modals-exercises.html
3. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
4. https://www.ego4u.com/en/cram-up/grammar/prepositions

LIST OF EXPERIMENTS

1. Listen to lectures- articulate a complete idea as opposed to producing fragmented utterances- Tedtalks, Science Fiction- My Fair Lady
2. Listening – following, responding to explanations, giving directions and instructions in academic and business contexts- IELTS,TOEFL.
3. Listening to transcripts and answer to the questions.
4. Listening for specific information: accuracy and fluency – BEC.
5. Reading: Different Text Type.
6. Reading: Predicting Content using pictures and titles.
7. Reading: Use of Graphic Organizers to review.
8. Reading: Aid Comprehension
9. Reading: Speed Reading Techniques.
10. Reading and Comprehending the passages in the competitive exams like GATE, TOEFL, GRE, IELTS, and other exams conducted by Central and state governments.

TOTAL : 30 PERIODS

REFERENCE BOOKS

1. SureshKumar.E and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Blackswan: Hyderabad,2012
2. Davis, Jason and Rhonda Liss. Effective Academic Writing (level 3) Oxford University Press: Oxford,2006
3. Withrow, Jeans and et al. Inspired to write. Reading and Tasks to develop writing skills. Cambridge University Press: Cambridge,2004

CO-PO MAPPING

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

Assessment (40% weightage) (Theory Component)		**Assessment** (60% weightage) (Laboratory Component)		**End Semester Examination**
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Evaluation of Laboratory Observation, Record**	**Test**	**Written Examination**
40	**60**	**75**	**25**	
100				**100**
50 %				**50 %**

23PH1101	ENGINEERING PHYSICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVE

- To impart knowledge in basic concepts of physics relevant to engineering applications.
- To introduce advances in technology for engineering applications.

UNIT–I PROPERTIES OF MATTERS 6

Elasticity: Stress, strain, Hooke's law and elastic moduli – stress-strain diagram – twisting couple per unit twist for solid cylinder – torsional pendulum (theory) – bending moment of beam – non-uniform and uniform bending (theory)– I-shape girder.

Thermal Physics: Mode of heat transfer: conduction, convection and radiation – thermal expansion of solids – bimetallic strips – thermal conductivity – Forbe's method and Lee's disc method; theory and experiment – thermal insulation – applications

UNIT–II SEMICONDUCTING AND MAGNETIC MATERIALS 6

Semiconducting Materials: Intrinsic Semiconductors – energy band diagram – carrier concentration in intrinsic semiconductors – extrinsic semiconductors (N-type & P-type) – variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration –Zener and avalanche breakdown in p-n junctions – Ohmic contacts – Schottky diode – tunnel diode.

Magnetic Materials: Magnetism in materials – Basic definitions – Classifications of Magnetic Materials- Ferromagnetic Domain theory – M versus H behaviour - Hard and Soft Magnetic materials- Magnetic principle in Computer data storage – Magnetic Hard Disc and Embedded systems**.**

UNIT–III MODERN OPTICS 6

Laser: Population of energy levels, Einstein's A and B coefficients derivation – optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction**– Fiber Optics**: components and principle of fiber optics – numerical aperture and acceptance angle derivation – types of optical fibers (material, refractive index, mode) – losses associated with optical fibers– fiber as pressure and displacement sensors.

UNIT–IV QUANTUM PHYSICS AND NANOSCIENCE 6

Quantum Physics: Blackbody radiation – Planck's hypothesis and derivation – wave particle duality of light: concepts of photon – de Broglie hypotheses – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations.

Nanoscience: Introduction – Classification of nanomaterials – preparation (bottom up and top down approaches), mechanical, optical and electrical properties – applications: NEMS and MEMS– carbon nanotubes: types.

UNIT–V ELECTROMAGNETIC WAVES 6

Divergence – curl – integral calculus – Gauss divergence theorem – Stoke's theorem – equation of continuity – displacement current – Maxwell's equations – Gauss's laws – Faraday's law –Ampere-Maxwell law – mechanism of electromagnetic wave propagation – Hertz observation – production and detection of electromagnetic wave – properties of electromagnetic waves.

TOTAL: 30 PERIODS

LIST OF EXPERIEMENTS

1. Determination of Moment of Inertia of the disc and Rigidity Modulus of the material of the wire – Torsional Pendulum
2. Determination of Young's Modulus – Non - Uniform Bending
3. Determination of Thermal Conductivity of the Bad Conductor – Lee's Disc Method
4. Determination of thickness of a thin wire – Air wedge method
5. (i) Determination of wavelength of Laser using Grating and Particle size determination
   (ii) Determination of Numerical Aperture and Acceptance angle of an Optical Fibre
6. Determination of Velocity of ultrasonic waves in a liquid and compressibility of the liquid – Ultrasonic Interferometer.
7. Determination of wavelength of Hg source using Grating by normal incidence method using spectrometer
8. Determine the band gap energy of a semiconductor.

TOTAL: 30 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:

CO1 Understand the basics properties of materials, especially elastic and thermal properties of materials.

CO2 Adequate knowledge on the concepts of semiconducting and magnetic materials and their applications in memory storage.

CO3 Acquire the knowledge on the concepts of lasers, fiber optics and their technological applications.

CO4 Knowledge on fundamental concepts of quantum theory, nanoscience its applications

CO5 Knowledge on the basics of electromagnetic waves and its properties.

TEXT BOOKS

1. AjoyGhatak, Optics, 5th Ed., Tata McGraw Hill, 2012
2. Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, Concepts of Modern Physics, 6th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014
3. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt Ltd., New Delhi, 2017
4. Karl F. Renk, Basics of laser physics: for students of science and engineering, 2017.

REFERENCE BOOKS

1. Halliday, D., Resnick, R. & Walker, J.—Principles of Physics, Wiley, 2015.
2. Tipler, P.A. &Mosca, G. — Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.
3. Ruby Das, C.S. Robinson, Rajesh Kumar, Prashant Kumar Sahu, A Textbook of Engineering Physics Practical, University Science Press, Delhi, II Edition (2016).

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	1						
CO2	3	3	2	1	2	1						
CO3	3	3	2	2	2	1						1
CO4	3	3	1	1	2	1						
CO5	3	3	1	1	2	1						

Assessment (40% weightage) (Theory Component)		Assessment (60% weightage) (Laboratory Component)		End Semester Examination
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Evaluation of Laboratory Observation, Record	Test	Written Examination
40	60	75	25	
100				100
50 %				50 %

23ES1111	PROBLEM SOLVING USING C PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- To write, test, and debug simple C programs.
- To implement C programs with conditional and looping statement
- To develop applications in C using strings, pointers, functions.
- To implement C programs with structures and union.
- To develop applications in C using file processing
- To develop an application in real time situation

LISTOFEXPERIMENTS

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions
   a) if it is a perfect cube
   b) if it is a multiple of 4 and divisible by 6
   c) if it is a prime number
   d) Sort the numbers based on the weight in the increasing order as shown below
   <10,its weight>,<36,its weight><89,its weight>
7. Populate an array with height of persons and find how many persons are above the average height.
8. Given a string —a$bcd./fg‖ find its reverse without changing the position of special characters. (Example input:a@gh%;j and output:j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions
10. From a given paragraph perform the following using built-in functions:
    a) Find the total number of words.
    b) Capitalize the first word of each sentence.
    c) Replace a given word with another word.
11. a) Sort the list of numbers using Selection sort and insertion sort
    b) Sort the list of numbers using pass by reference.
12. Search an element from an unsorted array using linear search
    Search an element in an array using Binary search recursion call.

13. Generate salary slip of employees using structures and pointers.

14. a) Programs using Pointers
    b) Pointer demonstration the use of & and *
    c) Access Elements of an Array Using Pointer
    d) Perform the string operations like Length of the String, Concatenation of string and compare the string using Pointer
    e) Count number of words, digits, vowels using pointers
    f) Add two matrices using Multidimensional Arrays with pointers
    g) Multiply two matrices using pointers
    h) Multiply two numbers using Function Pointers

15. Compute internal marks of students for five different subjects using structures and functions.

16. Program to demonstrate the difference between unions and structures

17. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

18. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

19. **MINIPROJECT**
    Create a—Railway reservation system with the following modules
    a) Booking
    b) Availability checking
    c) Cancellation
    d) Prepare chart

TOTAL:60 PERIODS

COURSE OUTCOME

Upon successful completion of the course, students will be able to:

CO1 Write, test, and debug simple C programs.

CO2 Implement C programs with conditionals and loops.

CO3 Develop C programs for simple applications making use arrays and strings.

CO4 Develop C programs involving functions, recursion, pointers, and structures and union.

CO5 Design applications using sequential and random access file processing.

CO6 Perform task as an individual and / or team member to manage the task in time

WEB REFERENCES

1. https://www.programiz.com/c-programming/examples
2. https://beginnersbook.com/2015/02/simple-c-programs/
3. https://www.programmingsimplified.com/c-program-examples
4. https://www.tutorialgateway.org/c-programming-examples/
5. https://www.javatpoint.com/c-programs
6. https://www.tutorialspoint.com/learn_c_by_examples/simple_programs_in_c.htm

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2								
CO2	3	2	2	1	3							
CO3	3	3	3	2	3							
CO4	3	2	2	1	3							
CO5	3	3	3	2	3							
CO6	3	2	2	1	3							

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23TA1101	HERITAGE OF TAMIL	L	T	P	C
		1	0	0	1

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 Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of 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.

Total : 15 PERIODS

TEXT-CUM REFERENCE BOOKS:

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 நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: InternationalInstitute of Tamil Studies.
7. Historical by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23TA1101	தமிழர் மரபு	L	T	P	C
		1	0	0	1

UNIT – I **மொழி மற்றும் இலக்கியம்** **3**

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

UNIT – 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 - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

UNIT – III **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்** **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

UNIT –IV **தமிழர்களின் திணைக் கோட்பாடுகள்** **3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

UNIT –V **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு** **3**

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

Total : 15 PERIODS

TEXT-CUM REFERENCE BOOKS:

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 நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: InternationalInstitute of Tamil Studies
7. Historical by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

SEMESTER – II

23MA1202	COMPLEX VARIABLES AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE

- To understand the concepts of vectors as it gives the insight into how to trace along the different types of curves
- To introduce the numerical techniques of interpolation in various intervals, numerical techniques of differentiation and integration in engineering disciplines
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations
- To understand the standard technique of a complex variable theory in particular of analytics functions and its mapping property
- Complex variable techniques have been used in a wide area of engineering.

UNIT - I VECTOR CALCULUS 9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane - Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes, rectangular parallelopiped, sphere and cylinder.

UNIT - II INTERPOLATION AND NUMERICAL DERIVATIVES AND INTEGRALS 9+3

Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference interpolation – Interpolation with equal intervals: Newton's forward and backward difference formulae- Numerical integration using Trapezoidal, Simpson's 1/3 rule.

UNIT - III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step methods : Taylor's series method – Euler's method - Modified Euler's method –Improved Euler's method- Fourth order Runge-Kutta method for solving first order equations - Multi step methods : Adams- Bash forth Predictor Corrector method, Milne's predictor corrector method for solving first order equations.

UNIT - IV ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic functions - Cauchy-Riemann equations – Necessary and sufficient conditions – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions by Milne Thomson method – Conformal mapping: $w = z+c$, cz, $1/z$, and bilinear transformation.

UNIT - V **COMPLEX INTEGRATION** **9+3**

Line integrals- Cauchy's integral theorem-Cauchy's integral formula - Singularities – Residues– Cauchy's residue theorem - Taylor's and Laurent's series expansions – Application of residue theorem for evaluation of real definite integrals – Use of circular contour and semi- circular contour (excluding poles on the real axis).

TOTAL : 60PERIODS

COURSE OUTCOME

Upon successful completion of the course, students will be able to:

CO1 Identify the gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.

CO2 Use interpolation methods to solve problems involving numerical differentiation and integration.

CO3 Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

CO4 Understand the concepts of analytic functions, harmonic functions and conformal mapping

CO5 Use complex integration techniques to solve engineering problems.

TEXT BOOKS

- Grewal B.S.,- "Higher Engineering Mathematics", KhannaPublishers,NewDelhi, 44th Edition,2018.
- B.V. Ramana, " Higher Engineering Mathematics", McGraw Hill Education, India.
- Bali N., Goyal M. and Walkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.,), New Delhi, 7th Edition, 2009.
- Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
- Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
- Sastry, S.S., "Introductory Methods of Numerical Analysis", 5th Edition, PHI Learning, 2015.

REFERENCE BOOKS

1. Erwin Kreyzig, “Advanced Engineering Mathematics”, John Wiley sons, 10th edition, 2015.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. O’Neil, P.V. “Advanced Engineering Mathematics”, Cengage Learning India Pvt. Ltd, New Delhi, 2007.
4. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
5. SankaraRao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt.Ltd, 4th Edition, New Delhi, 2017
6. Kandasamy, P., Thilagavathy ,K., and Gunavathy. S., “Numerical Methods”, S. Chand and Co.,2007.

ONLINE COURSES / RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma69
2. https://onlinecourses.nptel.ac.in/noc21_ma57

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									1
CO2	3	3	3									1
CO3	3	3	3									1
CO4	3	3	3									1
CO5	3	3	3									1

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1201	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To understand the concepts of resultant force and moment of a particle and rigid body
- To understand the concepts of equilibrium of particles and rigid bodies in 2D and 3D
- To understand the concepts of centroid, moment of inertia and mass moment of inertia
- To understand the concepts of kinematics of particles and rigid bodies
- To understand the concepts of kinetics of particles and rigid bodies
- To understand the concepts of frictional force

UNIT I BASICS AND STATICS OF PARTICLES 9

Introduction - Units and dimensions – Fundamental laws of Mechanics - Principle of transmissibility - Parallelogram and triangular Law of forces - Vectorial representation of forces - Vector operations of forces - Coplanar Forces - Rectangular components of force - Equilibrium of a particle - Lami's theorem – Forces in space system - Equilibrium of a particle in space – Equivalent systems of forces.

UNIT II STATICS OF RIGID BODIES , ANALYSIS OF TRUSSES AND FRAMES 9

Moments and Couples – Moment of a force about a point and about an axis – Varignon's theorem – moment of a couple - resolution of a force into a force and a couple - reduction of a system of forces - Single equivalent force - Free body diagram – Types of supports and their reactions – Equilibrium of Rigid bodies in 2D and 3D – Case studies.

Simple trusses - Method of joints, method of sections - joints under special loading conditions - space trusses - Analysis of frames.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9

Centroid of areas – simple and composite areas - Theorems of Pappus and Guldinus – Centre of mass – simple and composite volumes - Moment of inertia - simple and composite areas - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Radius of gyration – Product of inertia - Principal moment of inertia of plane areas - Mass moment of inertia of simple solids.

UNIT IV FRICTION AND ITS APPLICATIONS 9

Friction -Laws of dry friction - Angle of friction - Coefficient of static and kinetic friction – Sliding friction - Wedges – Ladder Friction - Surface contact friction Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt drives – Friction in brakes- Band and Block brakes - case studies.

UNIT V **DYNAMICS OF PARTICLES** **9**

Kinematics - Translation and Rotation of Rigid Bodies – Velocity and acceleration -General Plane motion of simple rigid bodies such as cylinder and sphere - Rectilinear Motion and Curvilinear Motion of Particles - Equations of Motions - Projectile Motion.

Kinetics - Newton's Second Law of Motion – D'Alembert's Principle – - Energy - potential energy - kinetic energy - conservation of energy - work done by a force - work energy method.

Concept of conservation of momentum - Impulse-Momentum principle - Impact - Direct central impact, oblique central impact, impact of a moving train on the spring board.

TOTAL :45 PERIODS

COURSE OUTCOME

Upon successful completion of the course, students will be able to:

CO1	Evaluate the resultant force and moment of 2D and 3D force systems.
CO2	Apply the concepts of equilibrium of particles and rigid bodies in engineering problems.
CO3	Evaluate the centroid, moment of inertia and mass moment of inertia of composite areas and volumes.
CO4	Apply the equations of linear and projectile motions to solve physical problems.
CO5	Apply the concepts of equilibrium of rigid bodies in engineering problems.

TEXT BOOKS

1. Beer F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers (In SI Units): Statics and

   Dynamics", 8thEdition, Tata McGraw-Hill Publishing Company, New Delhi, 2004.

2. Rajasekaran S and Sankarasubramanian G, "Engineering Mechanics Statics and

   Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

3. Balasubramaniam T.V and Murugan R, "Engineering Mechanics", 1st Edition, Vijay Nicole Imprints, 2015.

REFERENCE BOOKS

1. Irving H. Shames and Krishna Mohana Rao G., "Engineering Mechanics - Statics and Dynamics", 4thEdition, Pearson Education, 2006.
2. Hibbeller R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11thEdition, Pearson Education, 2010.
3. Meriam J.L and Kraige L.G, "Engineering Mechanics - Statics - Volume 1, Dynamics Volume 2", 3rdEdition, John Wiley & Sons,1993.
4. Bhavikatti S.S and Rajashekarappa, K.G, "Engineering Mechanics", New Age International (P) Limited Publishers, 2005.
5. Vela Murali, "Engineering Mechanics", Oxford University Press, 2010.

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1. http://www.iitg.ac.in/rkbc/me101/me101.htm
2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-050-engineering-mechanics-i-fall-2007/index.htm
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

ONLINE COURSES / RESOURCES

1. https://nptel.ac.in/courses/112/106/112106286/
2. https://nptel.ac.in/courses/122/104/122104015/

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3								3	3
CO2	3	3	3								3	3
CO3	3	3	3								3	3
CO4	3	3	3								3	3
CO5	3	3	3								3	3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ES1205	BASIC ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To learn the concepts related with Electrical circuits and Wiring.
- To understand basics of Semiconductor Devices and Instrumentation.
- To Study the working principles of Special machines.
- To study the concept of DC and AC Drives.
- To understand the concepts of Solar PV system and Hybrid Electric Vehicle.

UNIT - I BASIC CIRCUITS AND WIRING 9

Electrical quantities, Ohms Law, Kirchhoff's Laws -Series and Parallel Connections - Single phase and three phase system, Earthing and its types- Basic house wring and its types – safety measures at home and industry.

UNIT II SEMICONDUCTOR DEVICES AND MEASURING INSTRUMENTS 9

PN junction diode,-Zener diode – Half wave and Full wave rectifier, - Bipolar Junction transistors. Classification of instruments – Operating Principles of indicating Instruments – Moving iron, Moving coil and wattmeter

UNIT III DC DRIVES 9

Construction and working Principles of DC Motors, Starters, Armature and Field control, Speed control using controlled rectifiers and DC choppers.

UNIT IV AC DRIVES AND SPECIAL MACHINES 9

AC Drives: Construction and working Principles of Three phase Induction motor and synchronous Motor, voltage / frequency control. Special Machines: Construction and working of Brushless dc motor, Permanent magnet DC Motor, stepper motor

UNIT V SOLAR PV SYSTEM AND ELECTRIC VEHICLE 9

Solar PV system- Introduction-Comparison with electrical and hybrid electrical vehicle-Construction and working of PHEV-Block diagram and components-Charging mechanisms-Advantages of PHEVs- Solar and Battery powered Electric Vehicles.

TOTAL :45 PERIODS

COURSE OUTCOME

On successful completion of the course student will be able to:

CO1 Acquire basic knowledge on Basic Electrical circuits and House Wiring.

CO2 Acquire basic knowledge on semiconductor devices and Measuring Instruments

CO3 Explain the working principle and applications of DC and AC Drives.

CO4 Explain the working principle of Special Electrical Machines

CO5 Illustrate the concepts related in the Solar PV system and Hybrid Electric Vehicles.

TEXT BOOKS

1. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 2015.
2. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
3. Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, First edition 2017.
4. Vedam Subrahmaniam, "Electric Drives (Concepts and Applications)", Tata McGraw-Hill, 2010
5. Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, 2006

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1. Pillai.S.K "A First Course on Electric Drives", Wiley Eastern Limited, 2012.
2. Singh. M.D., K.B.Khanchandani, "Power Electronics", Tata McGraw Hill, 2012.
3. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
4. MehrdadEhsani, YiminGao, Sebastian E. Gay, Ali Emadi, 'Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design', CRC Press, 2004.

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1.https://electrical-engineering-portal.com/download-center/books-and-guides/electrical-engineering/basic-course

2.https://afdc.energy.gov/vehicles/how-do-all-electric-cars-work

ONLINE COURSES / RESOURCES:

1.https://archive.nptel.ac.in/courses/117/106/117106108/

2.https://archive.nptel.ac.in/courses/108/105/108105155/

3.https://archive.nptel.ac.in/courses/108/104/108104140/

4.https://onlinecourses.nptel.ac.in/noc22_ee53/preview

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1		1					1
CO2	3	2	2	2	1		1					1
CO3	3	2	2	2	1		1					1
CO4	3	2	2	2	1		1					1
CO5	3	2	2	2	2		1					2

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23HS1201	COMMUNICATIVE AND APTITUDE SKILLS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVE

- To develop linguistic and strategic competence in workplace context and to enhance language proficiency and thereby the employability of budding engineers and technologists.
- To improve the relevant language skills necessary for professional communication.
- To help learners to develop their listening skills, which will, enable them to listen to lectures and comprehend them by asking questions; seeking clarification and developing their speaking skills and to speak fluently in real contexts.
- To improve the verbal ability skill and communicative skill of the students.
- To enhance the analytical and problem solving skills of the students.
- To prepare them for various public and private sector exams & placement drives.

UNIT I INTERPERSONAL COMMUNICATION 6

Listening: Listening to Telephone Etiquettes and Conversations. **Speaking**: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks. **Reading**: Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting). **Writing**: Writing a Short Biography of an Achiever Based on Given Hints, **Grammar**: Comparative Adjective, Numerical Expressions and Sentence pattern. **Vocabulary Development**: Idioms and Phrases.

UNIT II TECHNICAL COMMUNICATION 6

Listening: Listening to Talks/Lectures Both General and Technical and Summarizing the Main Points. **Speaking**: Participating in Debates, TED Talks. **Reading**: Reading Technical Essays/ Articles and Answering Comprehension Questions. **Writing**: Summary Writing, Minutes of the meeting. **Grammar**: Prepositional Phrases and Relative Clauses. **Vocabulary Development:** Abbreviations and Acronyms.

UNIT III PROCESS DESCRIPTION 6

Listening: Listening to a Process Description and Drawing a Flowchart. **Speaking**: Participating in Group Discussions, Giving Instructions, Presentation. **Reading**: Reading Instruction Manuals **Writing**: Process Descriptions – Writing Instructions **Grammar**: Use of Imperatives, Tenses, Impersonal Passive Voice and Phrasal verbs **Vocabulary Development**: Misspelt words. Homophones and Homonyms.

UNIT IV **REPORT WRITING** **6**

Listening: Listening to a Presentation and Completing Gap-Filling Exercises. **Speaking**: Making Formal Presentations, **Reading**: Reading and Interpreting Charts/Tables and diagrams. **Writing**: Interpreting Charts/Tables and Diagrams, Writing a Report. **Grammar**: Reported Speech; Interrogatives- Question Tags and Articles – omission of articles **Vocabulary Development**: Technical Jargon.

UNIT V **INTERVIEW SKILLS** **6**

Listening: Listening to a Job Interview and Completing Gap-Filling Exercises **Speaking**: Mock Interview, Telephone Interviews &Etiquette, and Group Discussion. **Reading: Reading** a Job Interview, SOP, Company Profile and Completing Comprehension Exercises **Writing**: Job Applications and Resume. **Grammar**: Conditional Clauses, Modal verbs **Vocabulary Development:** Technical Vocabulary, Purpose Statement.

Aptitude Skills:

Ratio and Proportion – Ratio, Proportion, Simple equations, Problems on Ages.

Percentages - Percentages increase/decrease, Simple and Compound interest.

Number system - Factors, Multiples - HCF and LCM.

Permutation - Combination and Probability

TOTAL : 30 PERIODS

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1	Recognise the need for life skills; apply them to different situations, the basic communication practices in different types of communication.
CO2	Gain confidence to communicate effectively in various situations to acquire employability skills.
CO3	Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others.
CO4	Communicate effectively & appropriately in real life situation and enhance student's problem solving skill.
CO5	Prepare for various public and private sector exams & placement drives.
CO6	Enhance students' problem solving skills.

TEXT BOOKS

1. Board of Editors. English for Engineers and Technologists Volume 2 Orient Black Swan Limited, 2020.
2. Richards, C. Jack. Interchange, New Delhi: CUP, 2017.
3. Aggarwal R.S. Quantitative Aptitude for Competitive Examinations 3rd (Ed.) New Delhi: S.Chand Publishing, 2017.

REFERENCE BOOKS

1. Kumar, Suresh. E. Engineering English, Orient Blackswan: Hyderabad, 2015
2. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi, 2014.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007.
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.
5. Sharma ArunQuantitative Aptitude, 7th (Ed.). Noida: McGraw Hill Education Pvt. Ltd. .2016.

WEB REFERENCES

1. https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabularyexams/word-formation.
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018.
3. http://xn--englishclub-ql3f.com/grammar/parts-of-speech.html.
4. https://www.edudose.com/english/grammar-degree-of-comparison-rules
5. https://www.math-only-math.com/practice-test-on-ratio-and-proportion.html
6. https://www.hitbullseye.com/Simple-Interest-and-Compound-Interest.php

ONLINE COURSES / RESOURCES

1. https://basicenglishspeaking.com/wh-questions/
2. https://agendaweb.org/verbs/modals-exercises.html
3. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
4. https://www.ego4u.com/en/cram-up/grammar/prepositions
5. https://www.classcentral.com/course/quantitative-methods-4340
6. https://www.classcentral.com/subject/qualitative-research

LIST OF EXPERIMENTS

1. Speaking- sharing personal information- self introduction
2. Speaking- Group Discussion, Small talk or Peb Talk
3. Speaking- Presentation- Formal and Informal
4. Speaking- Mock Interview
5. Speaking- FAQ's on Job Interview
6. Speaking – JAM
7. Speaking- Debate and Story Narration
8. Writing: Error Detection- Spotting and reasoning the errors from the passages in competitive exams.
9. Writing: Letter of recommendation
10. Writing: Elements of a good essay
11. Writing: Types of essays. Descriptive – Narrative-Issue based.

TOTAL : 30 PERIODS

REFERENCE BOOKS

1. Kumar, Suresh. E. Engineering English, Orient Blackswan: Hyderabad, 2015
2. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi, 2014.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007.
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.
5. Sharma Arun.(2016). Quantitative Aptitude, 7th (Ed.). Noida: McGraw Hill Education Pvt. Ltd.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									**3**	**3**		**2**
CO2									**3**	**3**		**2**
CO3									**2**	**3**		**2**
CO4									**2**	**3**		**2**
CO5									**2**	**3**		**2**
CO6									**3**	**1**		**3**

Assessment (40% weightage) (Theory Component)		**Assessment** (60% weightage) (Laboratory Component)		**End Semester Examination**
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Evaluation of Laboratory Observation, Record**	**Test**	**Written Examination**
40	**60**	**75**	**25**	
100				**100**
50 %				**50 %**

23ES1203	FUNDAMENTALS OF PYTHON PROGRAMMING	L	T	P	C
		2	0	0	2

COURSE OBJECTIVE

- To know the basic programming constructs
- To use control structures in python
- To use python collections – Lists, Tuples and Dictionary
- To define Python functions and use Strings
- To learn about strings and its manipulations in Python.

UNIT - I INTRODUCTION TO PYTHON PROGRAMMING 6

Introduction to Python, Demo of Interactive and script mode, Tokens in Python – Variables, Keywords, Comments, Literals, Data types, Indentation, Operators and its precedence, Expressions, Input and Print functions, Type Casting.

UNIT II CONTROL STRUCTURES 6

Control Structures : Selective statements – if, if-else, nested if, if –elif ladder statements ; Iterative statements - while, for, range functions, nested loops, else in loops, break, continue and pass statements.

UNIT III COLLECTIONS 6

List: Create, Access, Slicing, Negative Indices, List Methods, and comprehensions

Tuples: Create, Indexing and Slicing, Operations on tuples.

Dictionary: Create, add, and replace values, operations on dictionaries. Sets: Create and operations on set.

UNIT IV FUNCTIONS 6

Functions: Types, parameters, arguments: positional arguments, keyword arguments, parameters with default values, functions with arbitrary arguments, Scope of variables: Local and global scope, Recursion functions.

UNIT V STRINGS 6

Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions, Regular expression: Matching the patterns, Search and replace

TOTAL :30 PERIODS

COURSE OUTCOME

On successful completion of the course student will be able to:

CO1 Understand the basic python programming constructs.

CO2 Develop and execute simple Python programs.

CO3 Write simple Python programs using conditionals and loops for solving problems.

CO4 Represent compound data using Python lists, tuples, dictionaries etc.

CO5 Develop programs using functions.

CO6 Develop programs using string functions.

TEXT BOOKS

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. Reema Thareja, ”Problem Solving and Programming with Python’’, 2nd edition, Oxford University Press, New Delhi, 2019.

REFERENCE BOOKS

1. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018
2. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.

ONLINE COURSES / RESOURCES

1. https://docs.python.org/3/tutorial/
2. https://www.w3schools.com/python/
3. https://www.tutorialspoint.com/python/index.htm
4. https://www.javatpoint.com/python-tutorial
5. https://nptel.ac.in/courses/

LIST OF EXERCISES

1. Basic Python Programs
2. Write programs to demonstrate different number data types in python
3. Develop python programs to demonstrate various conditional statements
4. Implement user defined functions using python
5. Develop python scripts to demonstrate built-in functions
6. Develop python programs to perform various string operations like slicing, indexing & formatting
7. Develop python programs to perform operations on List & Tuple
8. Demonstrate the concept of Dictionary with python programs
9. Develop python programs to perform operations on Sets.
10. Write a python program to find and replace all occurrences of one word with another.

TOTAL :30 PERIODS

CO-PO MAPPING

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

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23ES1212	TECHNICAL SKILL PRACTICES - I	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To impart essential problem solving skills through general problem solving concepts.
- To provide basic knowledge on programming essentials using C as implementation tool.
- To introduce various programming methods using C.

LIST OF EXPERIMENTS

1. Data Types, Variables, Operators
2. Expressions, Precedence , Operators
3. Conditional Statements , Switch Statements
4. Looping, Nested Loops
5. Problems on Bit Manipulation
6. Patterns
7. Number Problems
8. Array Basics , Static vs Dynamic Array, Two Dimensional Matrix
9. Structure , Union ,Storage Classes
10. Function , Parameters passing
11. Recursion
12. Strings
13. Pointers
14. Command Line Arguments, Pre-processors
15. File Handling & Exception Handling.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

CO1 Propose solutions for a given problem.

CO2 Infer the fundamental programming elements in C language and learn to apply basic control structures in C.

CO3 Demonstrate the applications of structures and unions.

CO4 Visualize the capabilities of modular programming approach in C.

CO5 Understand the basic principles of pointers and their association during implementations.

CO6 Apply various input, output and error handling functions in C.

TEXT BOOKS

1. ReemaThareja, ``Programming in C"", 2nd edition, OXFORD University Press, New Delhi, 2019.
2. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication,2016.

REFERENCES

1. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education,2014.
2. Herbert Schildt, “C: The Complete Reference”, Fourth Edition, McGraw Hill, 2000.

ONLINE COURSES / RESOURCES

1. https://www.javatpoint.com/c-programming-language-tutorial
2. https://www.tutorialspoint.com/cprogramming/
3. https://nptel.ac.in/Courses/

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3							3
CO2	3	3	3	3	3							3
CO3	3	3	3	3	3							3
CO4	3	3	3	3	3							3
CO5	3	3	3	3	3							3
CO6	3	3	3	3	3							3

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23ES1213	PRODUCT DEVELOPMENT LABOATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work;
- Sawing, Planning and making joints in wood materials used in common household wood work.
- Welding various joints in steel plates using arc welding work;
- Machining various simple processes like turning, drilling, tapping in parts.
- Assembling simple mechanical assembly of common household equipments.
- Studying sheet metal and foundry operations.
- Understanding basics of electrical engineering like wiring, measuring current.
- Understanding basics of electronics.

GROUP – A CIVIL & ELECTRICAL ENGINEERING

CIVIL ENGINEERING PRACTICES 15 PERIODS

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side and delivery side of a pump

d) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Introduction to Tools and Equipments

b) Simple Planning and sawing practice

c) Making Half Lap, Dovetail, Mortise and Tenon joints

WOOD WORK STUDY:

a) Studying joints in door panels and wooden furniture

b) Studying common industrial trusses using models.

ELECTRICAL ENGINEERING PRACTICES **15 PERIODS**

a) Residential house wiring using switches, fuse, indicator, lamp and energy meter.

b) Fluorescent lamp wiring.

c) Stair case wiring

d) Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

e) Measurement of energy using single phase energy meter.

f) Soldering practice – Components Devices and Circuits – Using general purpose PCB.

GROUP – B MECHANICAL AND ELECTRONICS

MECHANICAL ENGINEERING PRACTICES **15 PERIODS**

SHEET METAL WORK:

a) Demonstrating basic sheet metal operations

b) Making simple sheet metal objects like trays, funnels etc.

BASIC MACHINING WORK:

c) Introduction to Lathe, Dilling machine, Tools and Equipments

d) Simple Turning and facing

e) Step turning

f) Simple Drilling and Tapping of flat plate using drilling machine

FOUNDRY WORK:

a) Introduction to tools, equipments and basic operations used in Foundry

WELDING WORK:

a) Introduction to Arc welding and Gas welding Tools and Equipments

b) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

GROUP – B MECHANICAL AND ELECTRONICS

ELECTRONICS ENGINEERING PRACTICES **15 PERIODS**

a) Study of Electronic components and equipments – Resistor colour coding

b) Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.

c) Design of Half wave and Full wave Rectifier.

d) 2D & 3D Electrical wiring Model using suitable Software.

TOTAL : 60 PERIODS

COURSE OUTCOME

Upon successful completion of the course, students will be able to:

CO1 Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

CO2 Introduction to Lathe machine, Tools and Equipments with machining experiments

CO3 Carry out basic home electrical works and measure the electrical quantities.

CO4 Analyse the basic electronic circuits and to solder simple components on PCB and test simple electronic circuits.

CO5 Design and Construct 2D and 3D Electrical wiring model using suitable software.

TEXT BOOKS

1. Jeyapoovan T., Saravanapandian M. & Pranitha S., “Engineering Practices Lab Manual”, Vikas Puplishing House Pvt.Ltd, (2006)
2. Kannaiah P. & Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, (1999).
3. Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, (2007).

REFERENCE BOOKS

1. K.C. John, "Mechanical workshop practice", Second edition, PHI learning Pvt Ltd, New Delhi.

2. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, (2007)

WEB REFERENCES

1. https://nptel.ac.in/courses/112/107/112107090/

2. https://nptel.ac.in/courses/112/107/112107084/

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									3
CO2	3	3	3									3
CO3	3	2			1	1	1					2
CO4	3	2			1	1	1					2
CO5	3	2			1	1	1					2

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23ES1214	ELECTRICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- To understand the characteristics of semiconductor devices.
- To determine the characteristics of DC and AC machines
- To enable the students to be familiar with the speed control of DC Motors.

LIST OF EXPERIMENTS

1. Load test on DC Shunt and Series motor.
2. Load test on compound Motor
3. Speed control of DC shunt motor.
4. V curves and inverted V curves of synchronous Motor
5. Load test on three phase squirrel cage Induction motor.
6. Study of DC & AC Starters
7. Characteristics of Semiconductor diode and Zener diode
8. Characteristics of a NPN Transistor under common emitter, common collector and common base configurations
9. Simulation on motoring operation of DC motor
10. Simulation of Speed control of Dc motors using controlled rectifiers
11. Simulation of Speed control of Dc motors using DC choppers

TOTAL : 60 PERIODS

COURSE OUTCOME

On successful completion of the course student will be able to:

CO1 Infer the characteristics of BJT.

CO2 Compute performance characteristics of DC and AC Machines with various loads.

CO3 Analyze the speed characteristic of DC and AC Machines.

CO4 Analyze the characteristics of DC motor using Simulation software.

CO5 Simulate the Speed control of DC motors using controlled rectifiers and DC choppers

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2							1
CO2	3	2	2	2	2							1
CO3	3	2	2	2	2							1
CO4	3	2	2	2	2							1
CO5	3	2	2	2	2							1

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23TA1201	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT–I WEAVINGAND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age–Ceramic technology–Black and Red Ware Potteries(BRW) –Graffition Potteries.

UNIT–II DESIGNANDCONSTRUCTION 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 - ChettiNadu 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 AGRICULTUREAND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry -Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries —Pearl-Conchediving-AncientKnowledgeofOcean-KnowledgeSpecificSociety.

UNIT–V SCIENTIFICTAMIL & TAMIL COMPUTING 3

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.

Total : 15 PERIODS

23TA1201	தமிழரும் தொழில் நுட்பமும்	L	T	P	C
		1	0	0	1

UNIT–I நெசவு மற்றும் பானைத் தொழில் நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில் நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

UNIT–II வடிவமைப்பு மற்றும் கட்டிடத் தொழில் நுட்பம் 3

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர் மஹால் – செட்டிநாடு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசோனிக் கட்டிடக்கலை.

UNIT–III உற்பத்திதொழில்நுட்பம் 3

கப்பல் கட்டும் கலை - உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல் மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

UNIT–IV **வேளாண்மைமற்றும்நீர்பாசனத்தொழில்நுட்பம்** **3**

அணை, ஏரி, குளங்கள், மதகு – சோழர் காலக் குமிழித்தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு - மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவு சார்சமூகம்.

UNIT–V **அறிவியல்தமிழ்மற்றும்கணினித்தமிழ்** **3**

அறிவியல் தமிழின் வளர்ச்சி – கணினித் தமிழ் – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின்நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

Total : 15 PERIODS

TEXT-CUM REFERENCE BOOKS:

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 நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL–(in print)
6. Social Life of the Tamils-The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
7. Historical by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi-‘ Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by :Department of Archaeology & TamilNadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to TamilNadu (Dr.K.K.Pillay) (Published by:The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & TamilNadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by :RMRL)–Reference Book.

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

SEMESTER – III

23MA1303	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To understand the concepts of solving partial differential equation.
- To understand the concepts of Fourier series analysis.
- To apply the concept of Fourier series techniques in wave and heat flow problems.
- To introduce the basic concepts of Fourier transform techniques.
- To introduce the Z transform techniques for discrete time systems.

UNIT - I PARTIAL DIFFERENTIAL EQUATIONS **9+3**

Formation of partial differential equations - Solutions to standard types of first order partial differential equations - Lagranges linear equation - Second and higher order with constant coefficients of homogeneous linear partial differential equations.

UNIT - II FOURIER SERIES **9+3**

Dirichlet's conditions – General Fourier series - Odd and even functions - Change ofinterval-Halfrangesineseries–Halfrangecosineseries–RMSvalues-Parseval'sidentity–Harmonicanalysis

UNIT - III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **9+3**

Fourier Series Solutions of one dimensional wave equation –One dimensional equation of heat conduction— Steady state solution of two dimensional equation of heat conduction in Cartesian coordinates.

UNIT - IV FOURIERTRANSFORMS **9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem–Parseval's identity.

UNIT - V Z-TRANSFORMSANDDIFFERENCEEQUATIONS **9+3**

Z-transforms - Elementary properties –Initial and final value theorems- Inverse Z-transform (Using partial fraction method and Residue method)-Convolution theorem– Formation of difference equation-Solution of difference equations using Z –transform.

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand the concepts of partial differential equations and their solutions.

CO2 Understand the principles of Fourier series in real life situation

CO3 Solve one dimensional equation using Fourier series techniques.

CO4 Solve two dimensional equations using Fourier series techniques.

CO5 Understand the mathematical principles on Fourier transforms.

CO6 Apply the basic knowledge to solve difference equations using Z-transforms.

TEXT BOOKS:

1. Grewal B.S., “Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi,2014
2. NarayananS., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for
3. EngineeringStudents",Vol.II&III,S.ViswanathanPublishersPvt.Ltd,Chennai,1998.
4. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt.Ltd., NewDelhi,Secondreprint,2012.
5. NagarajanG. and SundarRa jM.," Transforms and Partial Differential Equations", Sree kamalamani Publications 6thedition,Chennai, 2021.

REFERENCE BOOKS:

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9thEdition, Laxmi Publications Pvt.Ltd, 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, JohnWiley, India,2016.
3. Ramana.B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt.Ltd, New Delhi, 2012.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1									1
CO2	3	3	1									1
CO3	3	3	1									1
CO4	3	3	1									1
CO5	3	3	1									1
CO6	3	3	1									1

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1301	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To evaluate the stresses on circular shafts and springs due to torsion and on cylinders due to internal pressures.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses..
- To evaluate the deflections and slope of beam under variable load conditions.
- To study the theory of columns.

UNIT - I STRESS, STRAIN AND DEFORMATION OF SOLIDS **9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

UNIT - II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM **9**

Beams – types, transverse loading on beams – Shear force and bending moment in beams – Cantilevers, Simply supported beams and overhanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shearing Stress at a Section in a Loaded Beam, Distribution of Shearing Stress over various cross section

UNIT - III TORSION **9**

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses and Deflection in helical and leaf springs.

UNIT - IV DEFLECTION OF BEAMS **9**

Deflection of beams - Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam method

UNIT - V THEORY OF COLUMNS, THIN CYLINDERS, SPHERES AND THICK CYLINDERS **9**

Euler's column theory – Euler's formula for various end conditions - Rankine's Formulae for Columns, Stresses in thin cylindrical and thick cylindrical shell due to internal pressure - circumferential and longitudinal stresses and deformation – Spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theorem.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1	Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes
CO2	Understand and applying the load transferring mechanism in beams and stress distribution due to shearing force and bending moment
CO3	Apply the basic equation of simple torsion and analyzing the stresses in shafts and helical spring
CO4	Evaluating the slope and deflection in beams using different methods.
CO5	Evaluating the buckling and crippling load of columns and Analyze and design thin and thick shells for the applied internal and external pressures

TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2018
2. R. Narayan and S. Ramamrutham," Strength of Materials", Dhanpat Rai Publishing Co., New Delhi, 19th editon, 2017

REFERENCE BOOKS:

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2019
2. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.
5. Gere & Timoshenko, "Mechanics of materials" Mcmillan company, 2009

WEB REFERENCES:

1. https://mechanicalc.com/reference/strength-of-materials

2. https://www.springer.com/journal/11223

3. https://www.engineersedge.com/strength_of_materials.htm

4. https://mechanicalbasics.com/strength-of-materials/

5. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/strength-of-materials.

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/105105108
2. https://www.digimat.in/nptel/courses/video/112107147/L01.html
3. https://nptel.ac.in/courses/112107146
4. https://www.nptelvideos.com/mechanical/strength_of_materials.php

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3			3						3
CO2	3	3	3			3						3
CO3	3	3	3			3						3
CO4	3	3	3	3								3
CO5	3	3	3	3		3	3					3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1302	MANUFACTURING PROCESSES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge to students in the scope of various manufacturing techniques.
- To create an awareness about the various metal joining process.
- To promote learning in the various hot and cold working techniques in metal forming process and sheet metal processing.
- To provide a complete insight in the manufacturing of various polymers and its composites

UNIT - I METAL CASTING PROCESSES 9

Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Mouldings and Properties and testing – Cores –Types and applications – Melting furnaces : Blast and Cupola Furnaces; Moulding machines– Types and applications; Principle of special casting processes : Shell - Investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO2process – Stir casting - Defects in Sand casting

UNIT - II JOINING PROCESSES 9

Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding- Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure. Case studies on welding in marine

UNIT - III METAL FORMING PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – forging operations. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts.

UNIT - IV SHEET METAL PROCESSES 9

Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes- Working principle and applications – construction, working and applications of Hydro forming and Rubber pad forming – Metal spinning– Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming

UNIT - V MANUFACTURE OF POLYMERS AND COMPOSITES 9

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding –applications – introduction to blow moulding –Rotational moulding –Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics; Manufacture of Composite materials - Powder metallurgy - Process, Compacting, Sintering, Vacuum processing- high energy compaction. Introduction to Additive Manufacturing.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1	Understand the various manufacturing process involved in processing different materials.
CO2	Understand the different joining techniques involved in the joining process of various metals.
CO3	Apply the hot working and cold working principles involved in the various metal forming processes.
CO4	Acquire abilities and capabilities in the areas of sheet metal processing techniques.
CO5	Evaluate the characteristics and method of manufacturing of the various types of polymers and composites.

TEXT BOOKS:

1. Hajra Chouldhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2021
2. Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 4th Edition,TMH-2018

REFERENCE BOOKS:

1. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India Edition,2013

WEB REFERENCES:

1. http://www.iitg.ac.in/manufacturing process
2. https://ocw.mit.edu/courses/manufacuturing process
3. http://hyperphysics.phy-astr.gsu.edu/hbase

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/112105306
2. https://nptel.ac.in/courses/112105233
3. https://nptel.ac.in/courses/112104189https://www.coursera.org/learn/manufacturing-process-fusion-360?

CO-PO MAPPING

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

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1303	ENGINEERING THERMODYNAMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.
- To understand the thermodynamics laws and its applications.
- To study the performance characteristics of vapour power cycles.
- To understand the relations on real gases, gas mixtures and on moist air.

UNIT - I BASIC CONCEPTS AND FIRST LAW 9

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

UNIT - II SECOND LAW AND AVAILABILITY ANALYSIS 9

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Irreversibility. I and II law Efficiency.

UNIT - III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

UNIT - IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 9

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties-.Compressibility factor-.Principle of Corresponding states. Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

UNIT - V GAS MIXTURES AND PSYCHROMETRY 9

Mole and Mass fraction, Dalton‟s and Amagat‟s Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process –adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand the fundamentals of various thermodynamics flow processes and thermodynamic laws.

CO2 Understand the fundamentals of availability, gas laws and thermodynamic relations for real gases and moist air.

CO3 Apply the first law of thermodynamics to steady and unsteady flow process.

CO4 Apply second law of thermodynamics to heat engine, heat pump and refrigerator.

CO5 Determine the properties of pure substance, performance of vapour power cycle.

CO6 Apply thermodynamic relations on real gases, gas mixtures and on moist air

TEXT BOOKS:

1. Nag.P.K.,“Engineering Thermodynamics”, 6thEdition, Tata McGraw-Hill, New Delhi, 2017.
2. R.K. Rajput, "Thermal Engineering", 10th Edition, Laxmi Publications (P) LTD, 2020.
3. Domkundwar, Kothandaraman, "A Course in Thermal Engineering", Dhanpat Rai & Co, 2016.

REFERENCE BOOKS:

1. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 7th Edition, Tata McGraw Hill, 2010.
2. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 1995.

3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006
4. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.
5. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2010.
6. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
7. Kau-Fui Vincent Wong, "Thermodynamics for Engineers", CRC Press, 2010 Indian Reprint.

WEB REFERENCES:

1. https://nptel.ac.in/courses/127106135

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/112105220

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										3
CO2	3	3										3
CO3	3	3	3				3					3
CO4	3	3	3	3			3					3
CO5	3	3	3	3			3					3
CO6	3	3	3	3			3			1		3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1304	ENGINEERING MATERIALS AND METALLURGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the material classification and mechanical properties, familiarize the iron carbon diagram in order to select for specific application.
- To acquire knowledge in the concepts of CCT Diagrams and the principles of various heat treatment process.
- To know and aware about the effects of alloying elements on the steel and various steel types.
- To understand the properties and applications of the non-ferrous metal and non-metallic materials.
- To understand the concept of various strengthening mechanisms.

UNIT - I MATERIALS AND MECHANICAL PROPERTIES 9

Classification of Materials - alloys types - Intermediate Alloy Phase/Compound , Solid Solutions - Mechanical Properties - Strength , Homogeneity, Isotropy, Anisotropy, Elasticity, Plasticity, Ductility, Malleability, Machine ability, Brittleness, Embrittlement, Hardness, Toughness, Stiffness, Impact strength, Resilience, Proof Resilience, Modulus of Resilience, Damping, Creep, Fatigue, Cohesion , Rupture - Iron carbon equilibrium diagram - Classification of steel and cast Iron and its microstructure, properties and applications.

UNIT - II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel- Austempering, martempering – Hardenability, Jominy end quench test - cooling curves superimposed on I.T. diagram CCR - case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

UNIT - III STEEL AND ITS CLASSIFICATIONS 9

Specification of steel - Effect of alloying additions on steel- α and β stabilizers – Alloy Steels-Ni Steel, Cr Steels, Nickel -Chromium Steels, Mn Steels, Mo Steels, W Steel, V Steels, and Si Steels - Stainless Steel - Tool steels - Dual Phase Steel – TRIP - HSLA - Maraging steels - properties and applications.

UNIT - IV NON FERROUS METALS AND NON METALLIC MATERIALS 9

Copper and copper alloys – Aluminium and Aluminium Alloys and Al-Cu – precipitation strengthening treatment – Bearing alloys - Magnesium alloys - Super alloys and its types - Titanium alloys. Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers - Engineering Ceramics – Properties and applications - Composites and its types - Applications of Composite.

UNIT - V STRENGTHENING MECHANISMS 9

Basic concepts: Dislocations and plastic deformations - Solid solution strengthening - strengthening by grain size reduction - Precipitation hardening - Particle and fiber dispersion strengthening- Strain hardening – Recovery - Recrystallisation and grain growth.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand material classification, heat treatment procedure, steel specification, application of non ferrous metals and dislocations theory.

CO2 Understand the properties of materials, types of heat treatment, uses of alloying elements in steel, application of non metallic materials, importance of slip and twinning,

CO3 Categorize the microstructure of cast iron, effect of alloying elements in steel, super alloys applications, deformation in slip and twinning,

CO4 Comment about the microstructure of steel and various hardening process, process of hardenability, polymers application, and importance of strengthening mechanisms.

CO5 Understand Iron carbon equilibrium diagram, importance of TTT and CCT curves, application of low and high alloys steel, composite and ceramics application, importance of recovery process.

TEXT BOOKS:

1. Avner, S.H., “Introduction to Physical Metallurgy”, McGraw Hill Book Company,2017.
2. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, Revised Indian Edition 2018

REFERENCE BOOKS:

1. Kenneth G.Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 2015.
2. Raghavan.V, “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd.,

2015.

3. U.C.Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012
4. Upadhyay. G.S. and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt. Ltd., New Delhi, 2006.

WEB REFERENCES:

1. https://www.theengineerspost.com/heat-treatment-of-steel/
2. https://unacademy.com/lesson/iron-carbon-equilibrium-diagram/KP6BFSGT
3. https://www.iqsdirectory.com/articles/powder-metal-parts/powder-metallurgy.html

ONLINE COURSES / RESOURCES:

1. NPTEL courses, http://www.nptel.iitm.ac.in/courses.php?disciplineId=112: related web and video resources under Mechanical Engineering &Metallurgy and Material Science categories.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3								3
CO2	3	3	3	3								3
CO3	3	3	3	3								3
CO4	3	3	3	3								3
CO5	3	3	3	3								3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23ME1305	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge on the properties of fluid and fluid statics principles
- Understanding major losses and minor losses in flow through pipes and interpret dimensional analysis.
- Expose to the working and construction of hydraulic machineries.
- To design the Pelton wheel, Francis and Kaplan turbines and Reciprocating and centrifugal pumps .

UNIT - I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions- Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity.

Fluid Statics: Pascal's Law – Pressure Variation in a Fluid at Rest– Absolute Pressure – Gauge Pressure – Atmospheric Pressure - Vacuum Pressures.

Flow characteristics - application of continuity equation, energy equation and momentum equation.

UNIT - II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – Types of boundary layer thickness – Darcy-Weisbach equation –friction factor- Moody diagram- Commercial pipes- Minor losses – Flow through pipes in series and parallel

UNIT - III DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – Methods of Dimensional Analysis – Similitude –Types of similitude - Dimensionless parameters- Application of dimensionless parameters – Model analysis

UNIT - IV HYDRAULIC PUMPS 9

Impact of jets - Euler's equation - Theory of Roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles –

Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

UNIT - V HYDRAULIC TURBINES 9

Classification of turbines - Axial, radial and mixed flow turbines – Heads and efficiencies – Velocity triangles. Pelton wheel, Francis turbine and Kaplan turbines- Working principles - Work done by water on the runner – Draft tube. Specific speed - unit quantities – Performance curves for turbines - Governing of turbines

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand the properties, characteristics of a fluid and working of pumps and turbines.

CO2 Remember the Energy losses in flow through pipe and applications of Bernoulli's equation.

CO3 Apply the Bernoulli's equation in flow through pipes and calculate major and minor losses associated with pipe flow in piping networks.

CO4 Analyse Mathematically to predict the nature of physical quantities in prototypes and models.

CO5 Evaluate the performance of centrifugal and reciprocating pumps , Pelton wheel, Francis and Kaplan turbines.

TEXT BOOKS:

1. Bansal R.K., "Fluid Mechanics and Hydraulic Machines", 10th Edition, Laxmi Publications, New Delhi, 2018.
2. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013**.**

REFERENCE BOOKS:

1. Hibbeler R.C., "Fluid Mechanics in SI units", 1st Edition, Pearson India Education Services Pvt. Ltd., Noida, 2017.
2. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
3. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
4. Robert W.Fox, Alan T. McDonald, Philip J. Pritchard, "Fluid Mechanics and Machinery", 2011.
5. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
6. Yunus A. Cengel, and John M. Cimbala, Fluid Mechanics, Third edition, Mc Graw Hill Education (India) Pvt. Ltd, 2014.

WEB REFERENCES:

1. https://energyeducation.ca/encyclopedia/Pelton_turbine
2. https://www.sciencedirect.com/topics/engineering/fluid-mechanics
3. https://www.annualreviews.org/journal/fluid
4. https://madhavuniversity.edu.in/fluid-mechanics-and-its-use.html
5. https://theconstructor.org/practical-guide/centrifugal-pump-working-types/2917/

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/112105183/.
2. https://nptel.ac.in/courses/112104118
3. https://nptel.ac.in/courses/105103192
4. https://nptel.ac.in/courses/112105171
5. https://onlinecourses.nptel.ac.in/noc21_ce56/preview

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3				3						3
CO2	3	3	3			3						3
CO3	3	3	3			3						3
CO4	3	3	3									3
CO5	3	3	3			3						3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1311	MANUFACTURING PROCESSES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- To practice the various manufacturing processes such as foundry, welding, sheet metal fabrication
- To perform basic machining operations using center lathe and shaper.

LIST OF EXPERIMENTS

1. Fabrication of sheet metal tray using shearing and bending operations.
2. Fabrication of a funnel using shearing and bending operations.
3. Fabrication of Lap Joint using Gas Metal Arc Welding
4. Fabrication of Butt Joint using Gas Metal Arc Welding
5. Fabrication of T-Joint using Gas Metal Arc Welding
6. Taper turning using Center Lathe - compound rest, Tailstock set over
7. Single and Multi start thread cutting - External and Internal
8. Knurling using Center Lathe
9. Eccentric Turning using Center Lathe
10. Square Head Shaping

Demonstration

11. Preparation of green sand mould with Solid Pattern / core
12. Brazing
13. Gas Welding
14. Manufacturing of sheet metal components using metal spinning on a lathe

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:

CO1 Understand the concept of various measuring instruments used in Industries.

CO2 Join two metals using GMAW.

CO3 Perform the work piece as per dimensions using machining operation Such as Turning, Shaping.

CO4 Analyse the various force acting on the tool for different machining operations.

CO5 Apply the sheet-metal tools and techniques to fabricate Tray and Funnel.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2					1		2			2
CO2	3	2					1		2			2
CO3	3	2					1		2			2
CO4	3	2					1		2			2
CO5	3	2					1		2			2

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23ME1312	STRENGTH OF MATERIALS AND FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

LISTOFEXPERIMENTS

STRENGTH OF MATERIALS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

FLUID MECHANICS AND MACHINERY

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Determination of friction factor for a given set of pipes.
4. Conducting experiments and drawing the characteristic curves of centrifugal pump
5. Conducting experiments and drawing the characteristic curves of reciprocating pump.

6. Conducting experiments and drawing the characteristic curves of Gear pump.
7. Conducting experiments and drawing the characteristic curves of Pelton wheel.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:

CO1 Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

CO2 Understand the heat treatment process of metals

CO3 Examine the hardened work piece.

CO4 Analyse the rate of flow using flow measurement devices

CO5 Analyse the performance characteristics tests on different fluid machinery

TEXT BOOKS:

1. R. K. Rajput, "A text book of Strength of Materials', S. Chand & Co. Ltd., 2018
2. R. K. Rajput, "A Textbook of Fluid Mechanics and Hydraulic Machines', S. Chand & Co. Ltd., 2015.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3						3		3	3
CO2	3	3	3						3		3	3
CO3	3	3	3						3		3	3
CO4	3	3	3						3		3	3
CO5	3	3	3						3		3	3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

SEMESTER – IV

23MA1404	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To provide necessary basic concepts in probability and some standard distributions applicable to engineering.
- To understand concepts of two dimensional random variables phenomenon.
- To understand the concept of testing of hypothesis for small and large samples in real life problems.
- To introduce the basic concepts of classifications of design of experiments.
- To introduce the statistical techniques using chart models.

UNIT - I RANDOM VARIABLES **9+3**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT - II TWO - DIMENSIONAL RANDOM VARIABLES **9+3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression - Central limit theorem (Without Proof).

UNIT - III TESTING OF HYPOTHESIS **9+3**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT - IV DESIGN OF EXPERIMENTS **9+3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT - V STATISTICAL QUALITY CONTROL **9+3**

Control charts for measurements (X and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand the basic concepts of one dimensional random variables and apply in engineering applications.

CO2 Apply standard distributions to solve real world problems.

CO3 Understand the basic concepts of two dimensional random variables and apply in engineering applications.

CO4 Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO5 Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO6 Formulate statistical techniques using chart models.

TEXT BOOKS:

1. Ibe, O.C.," Fundamentals of Applied Probability and Statistics ", 1st Indian Reprint, Elsevier, 2007.
2. Peebles, P.Z., "Probability, Random Variables and Statistics ", Tata McGraw Hill, 4th Edition, New Delhi, 2002.
3. Veerarajan T, “Probability, Statistics and Random Processes with Queueing Theory”, Mc GrawHill, 1st Edition, 2018.
4. HamdyATaha, Introduction to Probability and Statistics,Prentice Hall India,TenthEdition,ThirdIndian Reprint 2019.
5. Jay, L.Devore, “Probability and Statistics for Engineering and Sciences”, Brooks Cole Publishing Company, Monterey, California, 1982.

REFERENCE BOOKS:

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum’s Outlines on Probability and Statistics", Tata McGraw Hill Edition, 2004.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition,Elsevier, 2004.
4. Paneerselvam r., Probability and Statistics,Prentice Hall of India,Fourth Print, 2008
5. Gupta, S.C and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, New Delhi, 1999.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1									1
CO2	3	3	1									1
CO3	3	3	1									1
CO4	3	3	1									1
CO5	3	3	1									1
CO6	3	3	1									1

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1401	KINEMATICS OF MACHINERY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To identify and enumerate different link based mechanisms with basic understanding of motion.
- To interpret and analyse various velocity and acceleration diagrams for various mechanisms.
- To design and evaluate the performance of different cams and followers.
- To understand and illustrate various Gears and Gear trains using suitable method.
- To understand the importance of friction in machine elements.

UNIT - I **BASICS OF MECHANISMS** **9**

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Grubler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT - II **KINEMATICS OF LINKAGE MECHANISMS** **9**

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method–Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration –Introduction to linkage synthesis problem.

UNIT - III **CAM MECHANISMS** **9**

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams –Pressure angle and undercutting – sizing of cams.

UNIT - IV **GEARS AND GEAR TRAINS** **9**

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT - V **FRICTION IN MACHINE ELEMENTS** **9**

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt and rope drives – Friction in brakes - Band and Block brakes.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand the concepts of four bars, single and double slider crank chain and their inversions.

CO2 Determine the velocity & acceleration of given mechanism using graphical method.

CO3 Draw and develop the cam profile, and calculate the velocity and acceleration of circular and tangent cams.

CO4 Understand the gear dimensions and evaluate problems on gear trains.

CO5 Evaluate the Friction in clutch, bearings, brakes and belt drives.

TEXT BOOKS:

1. S. S. Rattan, “Theory of Machines”, McGraw Hill Publication, 5th edition, 2019
2. Uicker. J. J, Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms”, Oxford University Press, 2017

REFERENCE BOOKS:

1. Amitabha Ghosh and Ashok Kumar Mallik, “Theory of Mechanisms and Machines”, Affiliated East-West Pvt. Ltd., 2006.
2. Rao.J.S. and Dukkipati. R.V. “Mechanism and Machine Theory”, New Age International Pvt. Ltd., 2006.
3. F.B. Sayyad, “Kinematics of Machinery”, MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
6. Cleghorn. W. L, “Mechanisms of Machines”, Oxford University Press, 2014

WEB REFERENCES:

1. https://ekeeda.com/degree-courses/mechanical-engineering/kinematics-of-machinery
2. https://freevideolectures.com/course/2359/kinematics-of-machines
3. https://www.cloudkampus.com/course - details.php?course_id=232&c=Kinematics+of+Mechanisms+and+Machines+online-training-course

ONLINE COURSES / RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_me25/preview
2. https://www.coursera.org/courses?query=kinematics

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3		1				2			3
CO2	3	3	3		1				2			3
CO3	3	3	3		1				2			3
CO4	3	3	3		1				2			3
CO5	3	3	3		1				2			3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1402	THERMAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of Gas power cycles
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam nozzles, Gas Turbines, Compressors.

UNIT - I **GAS POWER CYCLES** **9**

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency-Comparison of cycles.

UNIT - II **INTERNAL COMBUSTION ENGINES** **9**

Classification - Components and their function. Valve timing diagram and port timing diagram - actual and theoretical p-V diagram of four stroke and two stroke engines. Simple and complete Carburetor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System - Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems. Performance calculation.

UNIT - III **STEAM NOZZLES AND TURBINES** **9**

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

UNIT - IV **AIR COMPRESSOR** **9**

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling–work of multistage air compressor.

UNIT - V **REFRIGERATION AND AIR CONDITIONING** **9**

Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia – Water, Lithium bromide – water systems (Description only). Air conditioning system - Processes, Types and Working Principles. - Concept of RSHF, GSHF, ESHF- Cooling Load calculations.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand the concepts and working of air standard cycles, IC engines.

CO2 Understand the working of steam nozzles and gas turbines

CO3 Understand the working of compressors, refrigeration and air conditioning systems

CO4 Analyze the performance calculations of air standard cycles and IC engines.

CO5 Analyze the performance calculations of steam nozzles, gas turbines, compressor, refrigeration and air conditioning systems

TEXT BOOKS:

1. R.K. Rajput, "Thermal Engineering", 10th Edition, Laxmi Publications (P) LTD, 2020
2. Domkundwar, Kothandaraman, "A Course in Thermal Engineering", Dhanpat Rai & Co, 2016

REFERENCE BOOKS:

1. Arora.C.P, ”Refrigeration and Air Conditioning ,” Tata McGraw-Hill Publishers 2008
2. Ganesan V..” Internal Combustion Engines” , Third Edition, Tata Mcgraw-Hill 2012
3. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.
4. Rudramoorthy, R, “Thermal Engineering “,Tata McGraw-Hill, New Delhi,2003
5. Sarkar, B.K,”Thermal Engineering” Tata McGraw-Hill Publishers, 2007.
6. Rakesh Kumar Maurya, "Characteristics and Control of Low Temperature Combustion Engines: Employing Gasoline, Ethanol and Methanol"(Mechanical Engineering Series)- Springer 2017.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=NakOoD-G0IY
2. https://www.youtube.com/watch?v=cT9UN1XENNk
3. https://www.youtube.com/watch?v=Hdy0il9nvI8

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/112103275
2. https://nptel.ac.in/courses/112106133

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										3
CO2	3	3										3
CO3	3	3					3					3
CO4	3	3	3				3					3
CO5	3	3	3				3			1		3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1403	METAL CUTTING AND MACHINE TOOLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- The course provides students with the fundamental knowledge and principles in material removal process.
- To demonstrate a better understanding on the constructional features and working principles of various machine tools.
- To demonstrate the applications of grinding and super finishing process.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

UNIT - I THEORY OF METAL CUTTING **9**

Mechanics of chip formation, single point cutting tool, forces in machining, cutting tool materials, tool wear, tool life, Types of chips, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, surface finish, cutting fluids and Machinability.

UNIT - II TURNING MACHINES **9**

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation.

Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle.

UNIT - III SHAPER, MILLING AND GEAR CUTTING **9**

Shaper - Types of operations. Drilling, reaming, boring, Tapping. Gear cutting – forming and generation principle and construction of gear milling, Hobbing and gear shaping processes –finishing of gears.Milling operations-types of milling cutter. Case studies about machining centers used in car manufacturing companies.

UNIT - IV ABRASIVE PROCESS AND BROACHING **9**

Abrasive processes: grinding wheel – specifications and selection, types of grinding process, construction and application – cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines.

UNIT - V **CNC MACHINING** **9**

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – Generation of Codes for simple components – Introduction to Additive Manufacturing

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1	Understand the mechanism behind the material removal processes.
CO2	Apply the principles of lathes / special purpose machines for various applications.
CO3	Understand the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.
CO4	Apply the concepts of abrasive particles based machining process and super finishing process.
CO5	Analyse the principles of CNC and to develop part programs for various applications.

TEXT BOOKS:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters 2021.
2. Rao. P.N “Manufacturing Technology - Metal Cutting and Machine Tools", 3rd edition, Tata McGraw-Hill, New Delhi, 2018.

REFERENCE BOOKS:

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J. White “MachineTool Practices”, Prentice Hall of India, 1998
2. Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", McGraw Hill, 1984.

WEB REFERENCES:

1. http://www.iitg.ac.in/rkbc/me101/me101.htm
2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-050-engineering-mechanics-i-fall-2007/index.htm
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

ONLINE COURSES / RESOURCES:

3. https://nptel.ac.in/courses/112104195
4. https://nptel.ac.in/courses/112104301
5. https://nptel.ac.in/courses/112107219

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3								
CO2	3		3		3							
CO3	3		3				3					
CO4	3		3				3					
CO5	3			3	3		3					3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ML1401	INTRODUCTION TO ARTIFICIAL INTELLIGENCE FOR MECHANICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understand the Foundations and Scope of Artificial Intelligence.
- Explore Various AI Techniques Relevant to Mechanical Engineering
- Examine the Integration of AI in Control Systems
- Analyze the Role of AI in Robotics
- Apply AI Techniques in Design and Simulation

UNIT - I **BASICS OF ARTIFICIAL INTELLIGENCE** **9**

Overview of Artificial Intelligence (AI), Historical Development of AI, Applications of AI in Mechanical Engineering, Ethical Considerations in AI

UNIT - II **AI TECHNIQUES IN MECHANICAL ENGINEERING** **9**

Knowledge-based Systems Expert Systems and Decision Support Systems, Fuzzy Logic and its Applications, Genetic Algorithms in Optimization Swarm Intelligence and its Role in Engineering

UNIT - III **AI IN CONTROL SYSTEMS** **9**

Introduction to Control Theory, Application of AI Techniques in Control Systems, Adaptive Control Systems Intelligent Control Techniques, Case Studies in AI-controlled Mechanical Systems

UNIT - IV **AI IN ROBOTICS** **9**

Fundamentals of Robotics, AI-based Robot Design and Control, Autonomous Navigation and Path Planning Human-Robot Interaction, Applications of Robotics in Manufacturing and Automation

UNIT - V **AI IN DESIGN AND SIMULATION** **9**

AI-driven Design Optimization, Knowledge-based Engineering, Virtual Prototyping and Simulation using AI, AI Applications in Finite Element Analysis (FEA), Case Studies in AI-enabled Design and Simulation

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand the fundamental concepts and historical development of Artificial Intelligence (AI) and its applications in Mechanical Engineering.

CO2 Identify various AI techniques and their roles in solving engineering problems without machine learning and deep learning.

CO3 Analyze the ethical considerations associated with the use of AI in Mechanical Engineering applications.

CO4 Apply AI techniques such as knowledge-based systems, expert systems, fuzzy logic, genetic algorithms, and swarm intelligence to solve engineering problems.

CO5 Demonstrate proficiency in utilizing AI in control systems, robotics, and design optimization in Mechanical Engineering contexts.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig - The latest edition, the fourth edition, was published in 2020.
2. Artificial Intelligence: Structures and Strategies for Complex Problem Solving by George F. Luger - The latest edition, the seventh edition, was published in 2019.
3. Artificial Intelligence: Foundations of Computational Agents by David L. Poole and Alan K. Mackworth - The latest edition, the second edition, was published in 2017.
4. Artificial Intelligence: A Guide to Intelligent Systems by Michael Negnevitsky - The latest edition, the third edition, was published in 2021.

REFERENCE BOOKS:

1. Artificial Intelligence: A New Synthesis by Nils J. Nilsson - The latest edition, the second edition, was published in 1998.
2. Artificial Intelligence: A Philosophical Introduction by Jack Copeland - The latest edition, the first edition, was published in 1993.
3. Artificial Intelligence: Structures and Strategies for Complex Problem Solving by George F. Luger - The latest edition, the seventh edition, was published in 2019.
4. Artificial Intelligence: A Guide to Intelligent Systems by Michael Negnevitsky - The latest edition, the third edition, was published in 2021.
5. Artificial Intelligence: Foundations of Computational Agents by David L. Poole and Alan K. Mackworth - The latest edition, the second edition, was published in 2017.

WEB REFERENCES:

1. http://nptel.ac.in/courses/111101003/
2. https://nptel.ac.in/courses/106/106/106106202/
3. https://nptel.ac.in/courses/112/103/112103280/
4. https://www.analyticsvidhya.com/

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1			1							
CO2	2	1			1							
CO3	2	1			1							
CO4	2	2			1							
CO5	2	2			1							

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ME1411	METAL CUTTING AND MACHINE TOOLS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- To acquire knowledge on various machining/finishing operations in special purpose machines.

LIST OF EXPERIMENTS

1. Various drilling operations using Radial drilling machine
2. Contour milling using Vertical milling machine
3. Spur gear cutting in Milling machine
4. Measurement of cutting forces in Lathe and Milling machine
5. Key way cutting using Slotting machine
6. Plain Surface grinding
7. Cylindrical grinding and Centerless grinding
8. Grinding of Single point cutting tool
9. Introduction to CNC Part Programming
10. Simple turning and facing using CNC Lathe
11. Contour milling using CNC Mill

DEMONSTRATION

1. Turret and Capstan Lathe
2. Helical Gear Cutting in Hobbing machine
3. Spur Gear generation in Gear shaping machine

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:

CO1 Understand the working principle of different machine tools

CO2 Apply different special machine tools for specific needs

CO3 Apply their knowledge to use machine tools for finishing operations

CO4 Manufacture tools using cutter grinder

CO5 Apply the basic concepts of CNC part programming in manufacturing

CO-PO MAPPING

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

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23ME1412	COMPUTER AIDED DESIGN LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- To impart knowledge and skills in modeling.
- To introduce the basics and standards of 3D drawing.
- To improve the knowledge of understanding the Assembly of the machine components.
- To understand the rendering module, layouts and printing.
- To apply the concepts of Topology optimization and Generative design.

UNIT - I GEOMETRY CREATION AND MODIFICATION **10**

Introduction to Computer Aided Design**,** Sketch Geometry - Create: Circle, Arc, Line, Rectangle, Ellipse, Spline, Text by using different option, Geometric construction option, Geometric selection method - Set working directory - Sketch Modification: Fillet, Chamfer, Offset - Datum plane Construction.

UNIT - II 3D SOLID GEOMETRY CREATION **10**

Introduction about working window of Solid Creation, 3D solid geometry command: Extrude, Revolve, Sweep, Variable sweep, Helical sweep, Swept blend and 3D Geometric modification - Creation of components in part Module : Support Brackets, Wall Brackets, Bearing Brackets, Flanges, etc.

UNIT - III ASSEMBLY MODELLING **20**

Assemble Part With Constrains - Creation of 3D assembly model using 3D Modelling software: Flange Coupling, Plummer Block, Screw Jack, Universal Joint, Machine Vice, Stuffing box , Safety Valves, Connecting rod, Piston - Create Animation for Assemble and Disassemble - Drawing Creation from 3D models.

UNIT - IV RENDERING MODULE, LAYOUTS, PRINTING AND OUTPUTS **10**

Rendering in Drawing Layouts - Creation of main view and projection view - Model scale and sheet size - View style, View display and Visible area - Section view creation and view states - Different view and add new model in sheet - Creation of Dimension in Drawing View - Generating bill of material.

UNIT - V TOPOLOGY OPTIMIZATION AND GENERATIVE DESIGN **10**

Objective function, Optimization variables, Constraints, Methods to quantify and compute objective function and constraints, Structural optimization - Topology optimization of components.

Note: Plotting of drawings must be made and attached to the records written by students.

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to:

CO1 Understand knowledge and skills in modeling.

CO2 Apply the basics and standards of 3D drawing.

CO3 Analyze the knowledge of understanding the Assembly of the machine components.

CO4 Apply the rendering module, layouts and printing.

CO5 Apply the concepts of Topology optimization and Generative design.

TEXT BOOKS:

1. Sandeep Dogra, "Creo Parametric 8.0: A Power Guide for Beginners and Intermediate Users", CADArtifex, 2021.
2. Michael Rider, "Designing with Creo Parametric 7.0", Taylor & Francis Group, August 2020.
3. Goutam Pohit, Goutam Ghosh, “Machine Drawing with AutoCAD”, Pearson, 2007.
4. Jasbir S. Arora, " Introduction to Optimum Design", 3rd Edition, Elsevier Academic Press, 2012.

REFERENCE BOOKS:

1. Matt Lombard, "Mastering SolidWorks", Wiley, 2018.
2. Bhatt N.D. and Panchal V.M, “Machine Drawing”, Charotar Publishing House, 46th Edition, 2011.
3. Bendsoe, M. P. and Sigmund, O., "Topology Optimization: Theory, Methods, and Applications," Springer, 2003.

CO-PO MAPPING

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

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23ME1413	HEAT ENGINES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- To impart knowledge on working of petrol and diesel engines.
- To understand valve timing and port timing of petrol and diesel engines.
- To improve the knowledge of understanding the heat balance test and performance test.
- To understand the performance of multi cylinder engine.
- To understand the performance and heat balance of Steam boiler and turbine.

LIST OF EXPERIMENTS

I.C. ENGINES LAB

1. Valve timing and port timing diagrams
2. Actual p-v diagrams of IC engines using Data Acquisition system
3. Performance test on 4-stroke diesel engine
4. Heat balance test on 4-stroke diesel engine
5. Morse test on Multi-cylinder petrol engine
6. Retardation test on a diesel engine
7. Determination of Flash point and Fire point of various fuels/lubricants

STEAM LAB

8. Study on steam generators and turbines
9. Performance and energy balance test on a steam generator
10. Performance and energy balance on steam turbine.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:

CO1 Understand knowledge in working of SI and CI engines.

CO2 Apply the basics in the performance characteristics of an IC engine

CO3 Analyze the knowledge of understanding the heat balance and retardation test on Diesel engine.

CO4 Analyze the Performance characteristics of a diesel engine using data acquisition system.

CO5 Analyze the performance and Energy balance of steam power unit.

CO-PO MAPPING

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

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**