Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya (SCSVMV)

(University U/S 3 of UGC Act 1956)
(Accredited with "A" Grade by NAAC)
Enathur, Kanchipuram - 631 561

DEPARTMENT OF MECHANICAL ENGINEERING

CURRICULUM AND SYLLABUS
(Regulation - 2025)

B.E. (Mechanical Engineering)

Choice Based Credit System

(Students Admitted from AY-2025-26)

PROGRAM OUTCOMES [PO's]	
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex Mechanical engineering problems
PO 2	Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO 3	Design/development of solutions: Design solutions for complex Mechanical 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
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, 5analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools that are relevant to Mechanical engineering, including prediction and modeling to complex engineering activities with an understanding of the limitations
PO 6	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 Mechanical engineering practice
PO 7	Environment and sustainability: Understand the impact of the Mechanical engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Mechanical engineering practice
PO 9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
PO 10	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
PO 11	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
PO 12	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

PROGRAM SPECIFIC OUTCOME (PSO's) – Mechanical Engineering	
PSO 1	Apply modern engineering tools such as CAD/CAM, Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), and automation technologies to analyze and solve complex problems in mechanical and interdisciplinary engineering domains.
PSO 2	Demonstrate technical competencies and innovative problem-solving abilities to address real-world challenges in sectors like automotive, aerospace, energy, and manufacturing through internships, industry-driven projects, and collaborative engagements

PROGRAM SPECIFIC OUTCOME (PSO's) – Mechatronics Engineering	
PSO 1	Graduates will be able to apply the integrated knowledge of mechanical, electrical, electronics, and computer engineering to design, develop, and implement intelligent mechatronic systems and automation solutions for real-world applications.
PSO 2	Graduates will be capable of designing and deploying embedded systems, control algorithms, and real-time interfaces to address challenges in automation, robotics, and various industrial domains.

CREDIT ASSIGNMENT

1 Hour Lecture (L) per week	**1 Credit**
1 Hour Tutorial (T) per week	**1 Credit**
1 Hour Practical (P) per week	**0.5 Credit**
2 Hours Project Per week	**1 Credit**

PROCEDURE FOR AWARDING MARKS FOR CONTINUOUS ASSESSMENT

Internal Assessment Marks for Theory Courses

- ✓ First internal test : 15 marks
- ✓ Second internal test : 15 marks
- ✓ Assignment : 10 marks

TOTAL MARKS : 40 marks

Internal Assessment Marks for Laboratory Courses

- ✓ Weekly lab performance : 15 marks
- ✓ Model lab Exam : 15 marks
- ✓ Record : 10 marks

TOTAL MARKS : 40 marks

Internal Assessment for Laboratory Integrated Theory Course

- ✓ First Internal test : 10 marks
- ✓ Second Internal test : 10 marks
- ✓ Internal lab Exam / Project work : 15 marks
- ✓ Assignment : 05 marks

TOTAL MARKS : 40 marks

SEMESTER - I (First year)										
SL. No	**Course Category**	**Course Code**	**Course Type**	**Name of the Course**	**Hours per week**			**Credit**	**IA**	**EA**	**TM**
					L	**T**	**P**				
1.	BSC			Mathematics –I (Calculus & Linear Algebra)	3	1	-	**4**	40	60	100
2.	BSC		L / T	Engineering Chemistry	3	-	2	**4**	40	60	100
3.	ESC			Basic Electrical Engineering	2	1	-	**3**	40	60	100
4.	ESC			Programming for Problem Solving	3	-	-	**2**	40	60	100
5.	ESC			Engineering Graphics & Design (Theory & Practical)	2	-	2	**3**	40	60	100
6.	BSC			Basic Electrical Engineering Lab	-	-	2	**2**	40	60	100
7.	ESC			Programming for Problem Solving Lab	-	-	2	**2**	40	60	100
Total					**13**	**02**	**08**	**20**			

SEMESTER - I (First year)										
SL. No	**Course Category**	**Course Code**	**Course Type**	**Name of the Course**	**Hours per week**			**Credit**	**IA**	**EA**	**TM**
					L	**T**	**P**				
1.	HSMC			English	2	-	-	**2**	40	60	100
2.	BSC			Mathematics – II (Calculus, Ordinary Differential Equations, and Complex Variables)	3	1	-	**4**	40	60	100
3.	BSC		L / T	Applied Physics for Engineers	3	-	2	**4**	40	60	100
4.	HSMC			Universal Human Values	3	-	-	**3**	40	60	100
5.	MC*			Environmental Science and Engineering*	2	-	-	**0**	100	-	100
6.	ESC		L / T	Design Thinking and Idea Lab	3	-	2	**4**	40	60	100
7.	HSMC			Soft Skills	2	-	-	**1**	100	-	100
8.	MC*			Industrial visit / Survey / Technical Seminar	-	-	-	**-**	**-**	**-**	**-**
9.	MC*			NSS / Technical Club / Green Cell / Archaeological Site Visit and Survey	-	-	-	**-**	-	-	-
Total					**18**	**01**	**04**	**18**			
Total Credit in First year								**38**			

SEMESTER - III (Second year)											
SL. No	**Course Category**	**Course Code**	**Course Type**	**Name of the Course**	**Hours per week**			**Credit**	**IA**	**EA**	**TM**
					L	**T**	**P**				
1.	BSC		T	Mathematics III (PDE, Probability & Statistics)	3	1	-	**4**	40	60	100
2.	ESC		T	Engineering Mechanics[$]	3	-	-	**3**	40	60	100
3.	PCC		T	Engineering Thermodynamics	3	-	-	**3**	40	60	100
4.	PCC		L / T	Manufacturing Science	3	-	2	**4**	40	60	100
5.	PCC		L / T	Materials Engineering[#]	3	-	2	**4**	40	60	100
6.	AEC		L	Programming Using Python lab[#]	1	-	2	**2**	40	60	100
7.	MC*		L	Skill Development Course-I*	-	-	-	**1***	100	-	100
Total					**16**	**01**	**06**	**20+1***			

SEMESTER - IV (Second year)											
SL. No	**Course Category**	**Course Code**	**Course Type**	**Name of the Course**	**Hours per week**			**Credit**	**IA**	**EA**	**TM**
					L	**T**	**P**				
1.	ESC		T	Electronics Engineering	3	-	-	3	40	60	100
2.	PCC		L / T	Thermal Engineering	3	-	2	4	40	60	100
3.	PCC		L / T	Fluid Mechanics & Machinery	3	-	2	4	40	60	100
4.	PCC		L / T	Machine Tools and Metal Cutting	3	-	2	4	40	60	100
5.	PCC		L / T	Strength of Materials	3	-	2	4	40	60	100
6.	AEC		L	Programming Using MATLAB#	1	-	2	2	40	60	100
7.	MC*		T	Sanskrit and Indian Culture	1*	-	-	1*	100	-	100
8.	MC*		L	Skill Development Course – II*	-	-	-	1*	100	-	100
9.	MC*		-	Summer Industrial Internship	-	-	-	1*	100	-	100
Total					**16**	**0**	**10**	**21+3***			

[$] Common to Mechanical, Mechatronics & Civil Engineering

[#] Common to Mechanical & Mechatronics Engineering

* Not accountable for GPA calculation

Course Type: T – Theory Course, L – Laboratory Course, L / T – Laboratory Integrated Theory Course

SEMESTER - I

Course Code	Course Name	Semester	Credits	L T P C
	ENGINEERING MATHEMATICS - I	1		3 1 0 4

COURSE OBJECTIVES

- To understand matrix theory, including eigenvalues, eigenvectors, and quadratic forms, for solving engineering problems
- To apply numerical methods for solving algebraic and transcendental equations using both direct and iterative techniques
- To learn interpolation, numerical differentiation, and integration methods for approximating functions and values.
- To evaluate multiple integrals and use Beta and Gamma functions in engineering applications.
- To apply vector calculus concepts and theorems to solve problems in physics and engineering fields

UNIT- I MATRICES — **9**

Eigen Value and Eigen Vectors – Properties of Eigen Values – Cayley-Hamilton Theorem – Reduction to Diagonal Form – Reduction of Quadratic Form to Canonical Form – Nature of Quadratic Forms.

UNIT-II NUMERICAL SOLUTIONS TO ALGEBRAIC EQUATIONS — **9**

Introduction – Solution of Algebraic and Transcendental Equations – Bisection Method, Method of False Position, Newton's Method – Solution of Linear Simultaneous Equations – Direct Methods of Solution – Gauss Elimination, Gauss-Jordan Method – Indirect Methods of Solution – Jacobi's Method, Gauss-Seidel Method.

UNIT-III INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION — **9**

Finite Differences – Newton's Interpolation Formula – Interpolation with Unequal Intervals – Lagrange's Formula – Divided Differences – Newton's Divided Difference Formula. Numerical Differentiation – Formulae for Derivatives – Numerical Integration – Newton-Cote's Quadrature Formula – Trapezoidal Rule – Simpson's 1/3rd Rule – Simpson's 3/8th Rule.

UNIT-IV MULTIPLE INTEGRALS AND BETA-GAMMA FUNCTIONS — **9**

Double Integrals – Change of Order of Integration – Double Integrals in Polar Coordinates – Area enclosed by Plane Curves – Triple Integrals – Volume of Solids – Beta Function – Gamma Function – Relation between Beta Function and Gamma Function

UNIT-V VECTOR CALCULUS — **9**

Scalar and Vector Point Functions-Vector Operator del. – Del applied to Scalar Point Functions-Gradient – Del applied to Vector Point Functions-Divergence and Curl – Del applied twice to Point Functions – Del applied to Product of Point Functions – Integration of Vectors – Line Integrals-Circulation-Work – Surface Integral-Flux – Green's Theorem in the Plane – Stoke's Theorem – Volume Integral – Divergence Theorem – Irrotational and Solenoidal Fields.(statement only for theorems).

CO	COURSE OUTCOMES
After successful completion of this course, students will be able to	
1.	Solve problems involving eigenvalues, eigenvectors, and reduce matrices and quadratic forms to canonical forms.
2.	Apply numerical methods to find approximate solutions of algebraic and transcendental equations.
3.	Use interpolation techniques and numerical integration/differentiation for estimating values from data.
4.	Evaluate double and triple integrals, and apply Beta and Gamma functions in engineering contexts.
5.	Compute gradient, divergence, and curl, and apply vector integral theorems in physical applications.

TEXT BOOK

1. B.S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers.

REFERENCE

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1														
CO2														
CO3														
CO4														
CO5														

ourse Code	Course Name	Semester	Credits	L T P C
	ENGINEERING CHEMISTRY	1		3 0 2 4

COURSE OBJECTIVES

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UNIT- I MOLECULAR ENGINEERING AND NANOTECHNOLOGY	9

Review of chemical bonding - MO theory – formation of H2,He2,O2,N2,CO and HF – hybridization definition- CH4,C2H4 and C2H2 - Supramolecular chemistry definition – types of molecular assemblies - molecular machines (concepts only) – Nanomaterials-differences between bulk and nanophases - synthesis (top-down and bottom-up) - Applications: sensors, energy devices, coatings

UNIT-II ENGINEERING MATERIALS – POLYMERS, CERAMICS & COMPOSITES	9

Polymers – introduction – types - advanced functional polymers -conducting polymers - biodegradable plastics – PLA and cellulose derivatives - Engineering ceramics – properties – types – oxide (Alumina and zirconia) non-oxide (SiC) and composite ceramics (metal cements) - applications - Composite materials: classification and uses.

UNIT-III ELECTROCHEMISTRY AND CORROSION CONTROL	9

Electrodes – types of electrodes – SEP – Nernst equation -Electrochemical cells, EMF, Nernst equation for cells -Batteries- Ni-Cd and Li-ion batteries - supercapacitors – introduction only - fuel cells introduction and types - Corrosion: types of corrosion - mechanisms, protection strategies.

UNIT-IV WATER TREATMENT TECHNOLOGY	9

Water as universal solvent – hardness-types - units of hardness -estimation of hardness - disadvantages of hard water – scale and sludges – water softening methods - ion exchange method, RO methods - Wastewater treatment: primary to tertiary methods - water pollutants types- heavy metals, microplastics and pesticide residues – effects. Domestic water treatment.

UNIT-V INTRODUCTION TO GREEN CHEMISTRY	9

Introduction to Green Chemistry – definition, scope, and significance - Twelve Principles of Green Chemistry – Atom Economy – definition, calculation, and applications, Carbon Footprint and Water Footprint – concepts and relevance in chemical industries -LCA – introduction- imporatnace- Green Synthetic Methodologies – use of green solvents, supercritical fluids, and ionic liquids - Solvent- Free Reactions – techniques and advantages - Microwave-Assisted and Sonochemical Reactions – principles, mechanisms, and applications.

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	Kinetics of Green synthesis of silver nanoparticles-Colorimetry
2.	Determination of hardness of water (EDTA method)
3.	Estimation of DO of water samples
4.	Estimation of COD of water samples
5.	Verification of Nernst equation for an electrode
6.	Electrochemical cell construction and EMF measurement
7.	Corrosion studies of metals
8.	Prediction of Feasibility of cells.
9.	Bioplastic preparation and testing.
10.	Ion exchange water purification
11.	Green synthesis of b*is*-naphthol
12.	Air particulate analysis using filter method

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	
2.	
3.	
4.	
5.	
TEXT BOOK	
1.	Jain & Jain, Engineering Chemistry, Dhanpat Rai Publishing, Latest Edition.
REFERENCES	
1.	P.C. Jain & Monika Jain, *Engineering Chemistry*, Dhanpat Rai Publishing
2.	Shashi Chawla, *A Textbook of Engineering Chemistry*, Dhanpat Rai & Co
3.	S.S. Dara & S.S. Umare, *Engineering Chemistry*, S. Chand & Company
4.	R. Mukhopadhyay, *Advanced Engineering Chemistry*, New Age International
5.	Anastas & Warner, *Green Chemistry: Theory and Practice*, Oxford University Press

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1														
CO2														
CO3														
CO4														
CO5														

Course Code	Course Name	Semester	Credits	L T P C
	BASIC ELECTRICAL ENGINEERING	1		2 1 0 3

COURSE OBJECTIVES

- To understand and analyze basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations.

UNIT-I DC CIRCUITS — **9**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation-Superposition, Thevenin and Norton Theorems.

UNIT-II AC CIRCUITS — **9**

Representation of sinusoidal waveforms, peak and rms values, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series), series resonance -Three-phase balanced circuit-voltage and current relationship in star and delta connections.

UNIT-III ELECTRICAL MACHINES (STATIC) — **9**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, transformer losses, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV ELECTRICAL MACHINES (ROTATING) — **9**

Construction and working principle – DC motor, Three-phase induction motor and Single- phase induction motor - torque –slip characteristics (three phase)-starting and speed control of three phase induction motor – Construction and working principle of DC generator and Three phase alternator.

UNIT-V POWER CONVERTER AND ELECTRICAL INSTALLATIONS — **9**

DC-DC buck and boost converters – Single phase voltage source inverters – Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Cables - Earthing - Types of Batteries - Power factor improvement.

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Explain the basic electrical quantities and laws
2.	Explain the construction, types and applications of electrical machines
3.	Study the working principles of power converters
4.	Show the tariff or a given load and energy consumption
5.	Introduce the components of low voltage electrical installations and its applications

TEXT BOOK

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2009.

REFERENCES

1. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	-	✓		
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO3	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	-	✓		
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

Course Code	Course Name	Semester	Credits	L T P C
	PROGRAMMING FOR PROBLEM SOLVING	1		3 0 0 2

COURSE OBJECTIVES

- The course is designed to provide complete knowledge of C and basic of C++.
- To provide students an exposure to gain the knowledge
- To ensure that students begin to learn the concepts of basic programming
- To design a creative solution for real world problems.
- To develop awareness of learning the basic concepts and creating algorithms.

UNIT - I COMPUTER BASICS	**9**
Introduction to components of computer system - Generation of programming languages - Types of Computers - Organization of Computers - Types of memory , Number systems - Idea of Algorithm -Pseudo code - Flow Chart with examples.	
UNIT - II DATA TYPE & CONTROL STRUCTURES	**9**
Introduction to C - Character set, Constants, Variables, Data Types – Operators –Arithmetic expressions and precedence – Decision Making statement - Looping statements.	
UNIT - III ARRAY, STORAGE CLASS, FUNCTIONS	**9**
Arrays and its types - Basic searching–Linear and Binary, Basic sorting, Storage class, Functions–Parameter passing in functions - call by value - call by reference – Passing array to functions-Recursive function.	
UNIT - IV STRUCTURE, UNION, STRINGS AND POINTER	**9**
Structure, array of structures, Union, array of union, String operations. Dynamic Memory Allocation, Introduction to Pointer, basic programs for Pointer arithmetic.	
UNIT - V FILE HANDLING, ,PREPROCESSORAND COMMAND LINE ARGUMENTS	**9**
Introduction to File –Reading File content to display in console, writing console content to file, read the content from file to the writing to another file, overwriting and appending file, random access file handing, Preprocessor directives, basics programs for Command line arguments.	

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Makes students gain a broad perspective about the uses of computers in the engineering industry.
2.	Develops a basic understanding of computers, the concept of algorithm and algorithmic thinking.
3.	Develops the ability to analyze a problem, develop an algorithm to solve it.
4.	Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.
5.	Introduces the features of data structures in this C Programming language.

TEXT BOOK	
1.	Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2.	Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Third edition, 2006
3.	Robert Lafore, "Object-Oriented Programming in C++" Pearson Education India, Fourth Edition
REFERENCES	
1.	Let Us 'C' - Yashawant Kanetkar, (Unit-II to V), BPB publications, 10th Edition, 2010
2.	Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008
WEB SOURCE REFERENCES	
3.	https://www.it.iitb.ac.in/lakshya/workshopContent.html?workshopid=FHf3Ht5njLv Vww7Tz3f8xg
4.	https://nptel.ac.in/courses/106104074

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1														
CO2														
CO3														
CO4														
CO5														

Course Code	Course Name	Semester	Credits	L T P C
	ENGINEERING GRAPHICS & DESIGN (Theory & Practical)	**1**		**2 0 2 3**

OBJECTIVES

- To introduce and develop the students towards the graphical skills for effective communication of concepts, ideas and design of engineering products.
- To make the students aware of existing national and international standards practiced in technical drawings, drafting and presentations.
- To introduce drafting software and its uses in design and detailing by using AutoCAD.

UNIT – I Introduction to Engineering Drawing	**5**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

UNIT – II Orthographic Projections	**5**

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

UNIT – III Projections of Regular Solids	**5**

Inclined to HP & VP - Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc

UNIT – IV Sections and Sectional Views of Right Angular Solids	**5**

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT – V Isometric Projections	**5**

: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

UNIT – VI	**5**

Overview of Computer Graphics-theory of CAD software-Drawing Area, Dialog boxes and windows- Different methods of zoom as used in CAD-Isometric Views of lines, Planes, Simple and compound Solids-Customisation & CAD Drawing-ISO and ANSI standards for coordinate dimensioning and tolerancing; dimensions to objects-various ways of drawing circles, Annotations, layering & other functions-Setting up and use of Layers, layers to create drawings-color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling-Introduction to Building Information Modelling (BIM)

LIST OF EXPERIMENTS

- Introduction to engineering design (CAD)
- Introduction to Auto CAD
- Introduction to BIM

1.	Drafting and modelling with co-ordinate systems
2.	Creation of a simple machined component
3.	Creation of title block
4.	Creation of orthographic views of a cone, cylinder and hexagon
5.	Creation of sectional views of a cone, cylinder and hexagon
6.	Creation of orthographic views
7.	Creation of isometric view of a V-block.
8.	Conversion of 3D to 2D drawings

9.	Creation of 3D solid machine component
10.	Creation of 3D solid V block
11.	Building plan of a simple office
12.	Building plan of a simple home
13.	Creation of simple steel truss

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Draw orthographic projections of lines, planes and solids
2.	Draw projections of solids including cylinder, prism and pyramid.
3.	Draw section of solids including cylinder, prisms and pyramids.
4.	Draw the development of surfaces including cylinder, pyramid and prism
5.	Draw projection of lines, planes, solids, orthographic projection, Isometric projection, and section of solids including cylinder, cone, prism, pyramid and building drawing using Auto CAD.
TEXT BOOK	
1.	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2.	Shah, M.B. & Rana B.C. (2010), Engineering Drawing and Computer Graphics, Pearson Education.
REFERENCES	
1.	Agrawal B. & Agrawal C. M. (2017), Engineering Graphics, TMH Publishers.
2.	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
3.	AUTO CAD User Manual.

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	✓	✓	✓	✓	✓								✓	✓
CO2	✓	✓	✓	✓	✓								✓	✓
CO3	✓	✓	✓	✓	✓								✓	✓
CO4	✓	✓	✓	✓	✓								✓	✓
CO5	✓	✓	✓	✓	✓								✓	✓

Course Code	Course Name	Semester	Credits	L T P C
	BASIC ELECTRICAL ENGINEERING LAB	1		0 0 2 2

COURSE OBJECTIVES

- To study the working of AC and DC drives.
- To measure the basic electrical parameters.
- To experimentally verify the networks theorems.
- To study the basic power conversion circuits.
- To study the working of basic electrical measuring instruments.

LIST OF EXPERIMENTS

1.	Study of Electric Motors (AC & DC Motors).
2.	Load Test on Single Phase Induction Motor.
3.	Load Test on Three Phase Induction Motor.
4.	Load Test on Single Phase Transformer.
5.	Load Test on Three Phase Alternator.
6.	Speed Control of DC Motor.
7.	Speed Control of Three Phase Induction Motor (Pole Changing Method).
8.	Study of Multi meter, CRO and LCR Meter.
9.	Measurement of Voltage, Current and Power.
10.	Verification of Kirchoff's Law.
11.	Verification of Thevenin's Theorem.
12.	B-H Curve of a Magnetic Material.
13.	Rectifier Circuit Analysis (AC – DC).
14.	Inverter Circuit Analysis (DC – AC).
15.	Chopper Circuit Analysis (DC – DC).
16.	Series and Parallel RLC Circuit Analysis.

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Study the various electrical parameters and the measuring instruments.
2.	Study the working of AC and DC drives.
3.	Design and experiment the various network theorems.
4.	Measure the power and power factor in AC circuit.
5.	Understand the three phases balanced and unbalanced supply.

TEXT BOOK

1.	D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2.	D. C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2009.

REFERENCES

1.	L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2.	E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3.	V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1														
CO2														
CO3														
CO4														
CO5														

Course Code	Course Name	Semester	Credits	L T P C
	PROGRAMMING FOR PROBLEM SOLVING LAB	**1**		**0 0 2 2**

COURSE OBJECTIVES

- The course aims to provide exposure to problem-solving through programming.
- To ensure that students begin to understand the fundamentals of Computer programming.
- To be able to effectively choose programming components to solve computing problems in real-world.
- To be able to formulate problems and implement in Computer programming.
- Learning the basic programming constructs them easily switch over to any other language in future.

LIST OF EXPERIMENTS

1.	Basic programs in data types.
2.	Problems in Decision making statements. a. Find the Biggest among 3 numbers. b. Find Even or odd. c. Arithmetic operations using Switch - Case Statements
3.	Problems in looping statements. a. Find the Sum of digits using (i) For loop (ii) While loop b. Generate the Fibonacci series c. Check whether the number is prime or not
4.	Matrix Manipulation-Addition, Subtraction and Multiplication
5.	String operations-string copy, string reverse, string concatenate
6.	Swapping of numbers using call by value, call by reference
7.	Find factorial using recursive functions
8.	Display the student information & marks using Structure & Unions
9.	Evaluate Expressions using library Function using C++ a. πr^2 b. (A+B+(2C/3A)+A2+2B) c. $\sqrt{S(S-A)\ (S-B)\ (S-C)}$ d. LOG $(x^3+y^3+z^3)$
10.	Numerical Methods-Quadratic Equation using C++
11.	Class and object
12.	To implement Constructor and Destructor
13.	To implement Inheritance.

CO	COURSE OUTCOMES	PO
Upon completion of this course, Students should be able to		
1.	Know the basic concepts in problem solving	**PO1, PO5**
2.	Demonstrate the algorithm and flow chart for the given problem	**PO2, PO4**
3.	Design and develop the program to evaluate simple expressions and logical operations.	**PO3**
4.	Write creative solutions using C &C++language	**PO3, PO4**
5.	Design and develop solutions to real world problems.	**PO5**

TEXT BOOK	
1.	Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2.	Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Third edition, 2006
3.	Robert Lafore, "Object-Oriented Programming in C++" Pearson Education India, Fourth Edition
REFERENCES	
1.	Let Us 'C' - Yashawant Kanetkar, (Unit-II to V), BPB publications, 10th Edition, 2010
2.	Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008
3.	Venugopal.K and Kavichithra.C, "Computer Programming", New Age International Publishers, First Edition, 2007
4.	Kernighan B.W and Ritchie,D.M , The C programming language: second edition, Pearson education,2006

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1														
CO2														
CO3														
CO4														
CO5														

SEMESTER - II

Course Code	Course Name	Semester	Credits	L T P C
	ENGLISH	2		2 0 0 2

COURSE OBJECTIVES

- Learn technical vocabulary and use it while speaking and writing in the professional arena.
- Help the students to understand the nuances of Grammar.
- To make learners acquire listening and help them to comprehend lectures and presentation.
- Develop strategies and skills to enhance students' ability to read and comprehend.
- Strengthen their proficiency in speaking and writing effectively which will help them comprehend lectures and talks in their areas of specialization.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT-I: Vocabulary Building — **9**

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

UNIT-II: Basic Writing Skills — **9**

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

UNIT-III: Identifying Common Errors in Writing — **9**

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

UNIT-IV: Nature and Style of sensible Writing — **9**

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

UNIT-V: Writing Practices — **9**

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

PRACTICE: ORAL COMMUNICATION

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Understand the nuances of grammar and vocabulary in speaking and writing.
2.	Listen and comprehend different spoken excerpts critically, infer and implied meanings.
3.	Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
4.	Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
5.	Write effectively and persuasively and by using different techniques of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
TEXT BOOK	
1.	Practical English Usage. Michael Swan. OUP. 1995
2.	Remedial English Grammar. F.T. Wood. Macmillan.2007
REFERENCES	
1.	On Writing Well. William Zinsser. Harper Resource Book. 2001
2.	Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006
3.	Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011
4.	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1														
CO2														
CO3														
CO4														
CO5														

Course Code	Course Name	Semester	Credits	L T P C
	Engineering Mathematics – II (Calculus, Ordinary Differential Equations, and Complex Variables)	**2**		**3 1 0 4**

COURSE OBJECTIVES

- To equip students with techniques to solve ordinary differential equations using analytical and numerical methods.
- To develop an understanding of partial differential equations and methods of finding their general and particular solutions.
- To introduce Fourier series and their applications in representing periodic functions.
- To familiarize students with Laplace transforms and their use in solving differential equations.
- To provide a foundation in Fourier transforms and their properties for analyzing signals and systems.

UNIT- I DIFFERENTIAL EQUATIONS **9**

Method of variation of parameters - Equations reducible to linear equations with constant coefficients: Cauchy's homogeneous linear equation.- solving of Ordinary differential equations using Numerical methods: Taylor's series, Runge-Kutta method of fourth order for solving first order equations - Milne's predicator corrector methods.

UNIT-II PARTIAL DIFFERENTIAL EQUATIONS **9**

Formation of partial differential equations – Solution of a partial differential equation – Equations solvable by direct integration – Linear equations of first order – Non linear equations of the first order – Charpit's method - Homogeneous linear equations with constant coefficients – Rules for finding complementary functions – Rules for finding particular integral – Solution of homogeneous linear equation of any order.

UNIT-III FOURIER SERIES **9**

Introduction - Euler's Formulae - Conditions for a Fourier expansion - Functions having points of discontinuity - Change of interval - Odd and even function - Expansions of odd or even periodic functions - Half-range series - Typical wave-forms - Parseval's formula

UNIT-IV LAPLACE TRANSFORMS **9**

Definition, Properties of Laplace transforms: Linearity Property, First shifting property, Change of scale property – Transforms of derivatives - Transforms of integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace transform - Inverse transforms: Method of partial fractions – Other methods of finding inverse - Convolution theorem (without proof) Application to differential equations

UNIT-V FOURIER TRANSFORMS **9**

Fourier integral theorem (without proof) - Fourier Sine and Cosine integrals – Complex form of Fourier integral - Fourier transform – Fourier sine and Cosine transforms – Properties of Fourier Transforms: Linear property, Change of scale property, Shifting property -Parseval's identity for Fourier transforms (without proof)

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Solve ordinary differential equations using analytical methods and numerical techniques such as Taylor's series, Runge-Kutta, and Milne's methods.
2.	Formulate and solve partial differential equations using appropriate methods including Charpit's method.
3.	Represent periodic functions using Fourier series and apply them to solve engineering problems
4.	Apply Laplace transforms and their properties to solve differential equations and evaluate integrals
5.	Use Fourier transforms to analyze signals and solve problems involving integral transforms

TEXT BOOK	
1.	B.S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers.
REFERENCES	
1.	Coddington, E. A, An Introduction to Ordinary Differential Equations. United Kingdom: Dover Publication. (2012)
2.	Simmons, G. F. Differential Equations: With Applications and Historical Notes. India: Tata McGraw-Hill. (2003)
3.	John, F. Partial Differential Equations. Germany: Springer New York(2013)
4.	Evans, L. C. Partial Differential Equations. United States: American Mathematical Society(2022)

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1														
CO2														
CO3														
CO4														
CO5														

Course Code	Course Name	Semester	Credits	L T P C
	APPLIED PHYSICS FOR ENGINEERS	2		3 0 2 4

COURSE OBJECTIVES

- Elastic properties of materials and their applications in beams, cantilevers and metallic ropes under torsion.
- Various acoustical effects in buildings and designing of auditorium for better acoustics.
- Einstein's theory on matter-radiation interaction, Laser principle and Properties, Nd:YAG and CO2 lasers, applications of lasers – IR thermography, light propagation in optical fiber, fiber parameters, types and applications, fiber losses
- Black body radiation, wave particle duality, De Broglie matter waves, physical significance of wave function, Schrodinger time wave equations.
- Dielectric materials, internal field, Superconductors, nanomaterial, methods of synthesis, shape memory alloys (SMA) and Biomaterials

UNIT- I PROPERTIES OF MATTER — **9**

Stress – Strain – Hooke's law – Elastic Behavior of Material – Young's modulus by cantilever depression – Non-uniform bending. Torsional Pendulum – Couple per unit twist of a wire-Time period-Application- Determination of Rigidity Modulus.

UNIT-II TECHNICAL ACOUSTICS — **9**

Acoustics of buildings – Reverberation- Weber Fechner law- Factors affecting acoustics of a building and remedies –Sabine's formula for reverberation time- Absorption coefficient. Ultrasonic waves - Properties - Generation – Piezoelectric method, Detection – Kundt's tube method, Applications – NDT.

UNIT-III LASER PHYSICS — **9**

Einstein's theory of matter - radiation interaction and A and B coefficients; Properties of laser- spontaneous and stimulated emission, amplification of light by population inversion, different types of lasers: solid-state laser(Nd:YAG), gas lasers (CO2), applications –IR Thermography.

UNIT-IV FIBRE OPTICS — **9**

Optical fibre- structure – core and cladding - principle [TIR] - types- material, mode, refractive index profile - Fibre losses -Expression for acceptance angle and numerical aperture. Application-optical fiber- Endoscope, Optical Fiber Communication.

UNIT-V ENGINEERING MATERIALS — **9**

Dielectric materials- Definition– Dielectric loss – Internal field – Claussius Mossotti relation. **Superconducting materials** -Introduction – Properties-Meissner effect – Type I & Type II superconductors – BCS theory. **Nanomaterial**- Introduction – Synthesis of nano materials – Top down and Bottom up approach- Ball milling- PVD method. **Smart materials**- Shape memory alloys-Biomaterials (properties and applications).

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	Determination of Rigidity Modulus & Moment of Inertia using Torsional Pendulum
2.	Determination of Young's Modulus.
3.	Determination of Wavelength of Laser light using transmission grating
4.	Determination of particle size using LASER
5.	Measurement of numerical aperture of an optical fiber.
6.	Determination of wavelength of light using Newton's Rings apparatus
7.	Determination of Velocity of sound waves in liquid using Ultrasonic interferometer
8.	Determination of wavelength of prominent colours of mercury spectrum using grating
9.	Determination of number of lines per meter of the grating using normal incidence method
10.	Determination of refractive index of the given prism using minimum deviation method

11.	Determination of emissivity of the surface of a black body
12.	Basic logic gates- Verification of truth tables
13.	NAND-Universal building block
14.	NOR-Universal building block
15.	Zener diode- I-V characteristics
16.	Study of LCR circuit
CO	**COURSE OUTCOMES**
At the end of the course, the student will gain adequate knowledge about	
1.	Young's modulus, bulk modulus and rigidity modulus of materials, cantilevers and metallic ropes under torsion
2.	Various acoustical problems in buildings and designing of auditorium for better acoustics
3.	Spontaneous and stimulated emissions, basic principles and properties of Laser, designing and working of Nd: YAG and CO2 lasers, applications, IR thermograph, optical fiber, fiber parameters, types and applications, fiber losses
4.	Black body radiation, wave particle duality, De Broglie matter waves, physical significance of wave function, Schrodinger time wave equations
5.	Dielectric materials, Superconductors, nanomaterials, Ball milling and PVD method of synthesis, shape memory alloys (SMA) and Biomaterials their nature and applications
TEXT BOOKS	
1.	V. Devanathan, "Quantum Mechanics", Narosa, 2011
2.	M.N. Avadhanulu, "Engineering Physics", S Chand & Co, 2007
3.	Charles Kittel , "Introduction to Solid state Physics", Wiley Student Edition, 2019
4.	D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", Wiley, 2001
5.	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, "Concepts of Modern Physics", McGraw Hill, 2017
REFERENCES	
1.	K.Venkatramanan, R.Raja, M.Sundarrajan, "Applied Physics for Engineers", Scitech, 2014 [units I, III-V]
2.	Sathyaprakash, "Quantum Mechanics", Pragati Prakashan, 2016 [unit IV]

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1														
CO2														
CO3														
CO4														
CO5														

Course Code	Course Name	Semester	Credits	L T P C
	UNIVERSAL HUMAN VALUES	**2**		**3 0 0 3**

COURSE OBJECTIVES

- To help the students appreciate the complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence.
- To highlight Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Unit – I: Introduction to Value Education **9**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations

Unit - II: Harmony in the Human Being **9**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Unit III: Harmony in the Family and Society **9**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-toHuman Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Unit – IV : Harmony in the Nature/Existence : **9**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Unit - V: Implications of the Holistic Understanding – a Look at Professional Ethics **9**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

CO	COURSE OUTCOMES
At the end of the course the students will be able to	
1.	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind
2.	They would have better critical ability.
3.	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)
4.	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

TEXT BOOK	
1.	The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 97893-87034- 47-1
2.	The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

REFERENCES

References:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas.
5. Karamchand Gandhi [5]. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews.
7. Economy of Permanence - J C Kumarappa.
8. Bharat Mein Angreji Raj – Pandit Sunderlal.
9. Rediscovering India - by Dharampal.
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
11. India Wins Freedom - Maulana Abdul Kalam Azad.
12. Vivekananda - Romain Rolland (English).
13. Gandhi - Romain Rolland (English).
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16. A Nagraj, 1998, JeevanVidya EkParichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantra Shodh, Amravati.
20. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press.
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

- Value Education websites,
- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

Course Code	Course Name	Semester	Credits	L T P C
	ENVIRONMENTAL SCIENCE AND ENGINEERING	**2**		**2 0 0 0**

COURSE OBJECTIVES

- To familiarize the students with basic concepts of environment
- To understand their role and responsibility of an individual in the environmental conservation.

UNIT-I: Introduction to environment and environmental studies	**9**

Introduction to environment – components – nature of environment - need of awareness –reason for environmental problems – anthropocentric and eco centric views.
Environmental studies - multidisciplinary nature – scope and aim – sustainable development- principles – RRR concept-Indian environmental movements – environmental calendar.

UNIT-II: Ecosystem and Biodiversity	**9**

Ecosystem – structure – functions – simplified ecosystem models (food chain and food webs and their types,energy flow) - forest – grassland – pond –ecosystems – ecological succession - ecological pyramids – Bio-geochemical cycles of water – oxygen-carbon-phosphorous and sulphur.
Biodiversity – definition – types – species – genetic and ecosystem diversities- values of biodiversity – threats to biodiversity – conservation of biodiversity – endemism – biodiversity hotspots – Indian biodiversity– endemic species of India – IUCN lists -red-green and blue data books.

UNIT-III: Natural resources	**9**

Natural resources – definition – types – forest resources – uses –deforestation- reasons - effects –water resources – dams – effects of dams - food resources – modern agriculture– ill effects -energy resources- types – hydel –nuclear – solar –wind and biomass energy - world scenario – Indian scenario.
Population and environment – reasons for over exploitation of resources – population – demography – population curves – population explosion – effects – consumerism – effects – urbanization – reasons and effects- role of an individual.

UNIT-IV: Environmental Pollution	**9**

Pollution – definition – types – air pollution – causes and effects – effects of CO_2 – CO – NOx –SOx – particulates – control of air pollution – water pollution – causes – effects – remedies – soil pollution – solid waste management – e waste – ill effects of e-waste – proper recycling- Noise pollution – reasons – effects – control – nuclear pollution – causes – effects and control –thermal pollution - causes – effects and remedies.
Legal provisions for protecting environment – article 48 A – 51 A (g) – Environment act 1986 – Air act 1981 – Water act 1974 – wild life protection act – Forest act 1980- problems in implementation–reasons.

Unit-V: Social issues and environmental ethics	**9**

Present environmental scenario – green house effect – climate change – The Kyoto Protocol – ozone layer depletion-The Montreal Protocol - acid rain – causes – effects - disparity among the nations – The Copenhagen UNFCCC summit – carbon currency- virtual water- genetically modified organisms, Disaster management.
Environmental ethics – introduction – people getting affected - resettlement and rehabilitation – issues involved –Sardhar Sarovar project – Tawa Matsya sang - Melting icebergs of Arctic.

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Understand the individual responsibility towards environment
2.	Create Eco-centrism approach towards sustainable society
3.	Enable the learners to understand, think and evolve strategies for management and conservation of environment for sustaining life on earth.
4.	Develop a new solution towards various environmental problems
5.	Understand the current environmental trends of India and the world and about environmental legislation
TEXT BOOK	
1.	Anubha Kaushik and C.P. Kaushik, "Prospects of Environmental Science", New Age International publishers, 2013
REFERENCES	
1.	Environmental Studies, N. Nandini, N. Sunitha and Sucharita Tandon, Sapna Book House, 2007
2.	Text book of Environmental Science, Ragavan Nambiar, Scitech Publications, 2009
3.	Text book of Environmental Chemistry and Pollution Control, S.S.Dara, S.Chand and Co., 2002
4.	Environmental Chemistry, Colin Baird, W.H.Freeman and company, New York,1999
5.	Environmental Chemistry, Gary W. VanLoon and Stephen J.Duffy, Oxford University Press, 2000
6.	New Trends in Green Chemistry, V.K. Ahluwalia and M. Kidwai, Anamaya Publishers, 2006

Course Title	DESIGN THINKING AND IDEA LAB	Semester	Credits	L T P C
Course Code		2		3 0 2 4

OBJECTIVES

- To understand various learning process, understanding the problems and enhancement techniques on innovative engineering products.
- To understand the importance of the design thinking tools.
- To learn about the problem-solving techniques and gain the knowledge about Empathy methods.
- To develop skills in ideation, product design tools and prototyping.
- To develop skills in testing, innovations, and collaboration on novel products.

UNIT - I BASICS OF LEARNING, UNDERSTANDING AND ENHANCEMENT TECHINIQUES **9**

Principles and Dimensions of Learning Process – Learning Styles - Human Centered Design – Assessing and Interpreting – Learning Retention process – Memory Enhancement Techniques – Emotions and Psychology – Importance of Peer Learning.

UNIT - II DESIGN THINKING TOOLS & TECHNIQUES **9**

Design Thinking process – Need of Design Thinking – Objectives of Design Thinking – Design Thinking Frameworks – Design Thinking Mindsets – Design Thinking Tools – Empathize, Define, Ideate, Prototype and Test.

UNIT - III EMPATHY **9**

Role of Empathy – Methods and tools of Empathy – Defining the problem – Analysis and Synthesis – Empathy Mapping & its types – Double diamond design thinking -Ethical reasoning.

UNIT - IV IDEATION, PROTOTYPING & TESTING **9**

Ideation methods – Brainstorming techniques - Prototype – Need of Prototype – Types of Prototype – Rapid Prototyping – Testing: Purpose of testing – Types of testing - Designing for business growth

UNIT - V ETHICS & SUSTAINABILITY **9**

Values of morals – Five ways of ethical thinking – Ethical issues – Sources of ethics – Universal principle of Ethics – Ethical design test – Sustainability and sustainable futures – Pillers of sustainability – Sustainable design – Desing thinking for 2030 agenda.

CASE STUDIES (Practical only)

Real life case studies – Karnataka health promotion trust – Shriram life insurance corporation – Government of Odisha – Kotak Mahindra Bank - Design Thinking for Patient waiting in Hospitals - Design Thinking for Higher Education – Design Thinking for developing the application / Technology – Design Thinking for Patient waiting in Hospitals - Design Thinking for Seat confirmation in Train/Flight transport - Design Thinking for reducing effect of Global warming.

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	To study the working principles and operation of normal lathe machine.
2.	To study the, working and operation of different welding equipment's.
3.	To study the working principles and operation of wood lathe machine.
4.	To study the machining of 3D geometry on soft material such as soft wood or modelling wax.
5.	To study the 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6.	To study the 3D 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm

	thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver
7.	Scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
8.	Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
9.	Embedded programming using Arduino and/or Raspberry Pi.
10.	Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
❖ Discussion and Implementations of a Mini Project ❖ Documentation of the Mini Project (Report & Video)	
CO	**COURSE OUTCOMES**
Upon completion of this course, Students should be able to	
1.	Classify the various learning principles and styles, memory technologies, and assess the emotional experience when examining emotional expressions in engineering education in order to create novel products.
2.	Discover the importance of brainstorming and how to apply design thinking tools to produce new products through innovative thinking.
3.	Propose the suitable problem-solving techniques through different Empathy tools and methods on defining problem statement on new products.
4.	Generate new ideation techniques applied on new product design and evaluate prototype effectiveness on different suitable developed prototype models.
5.	Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications.
TEXT BOOKS	
1.	Balaguruswamy, E., "Design Thinking", Mc Graw Hill, First Edition, January 2024.
2.	Idris Mootee, Design thinking for strategic innovation, Wiley publications, 2013.
3.	Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011.
4.	Michael Lewrick, Patrick Link, and Larry Leifer, The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems, 2018, John Wiley & Sons.
REFERENCES	
1.	Tom Kelley, The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, Currency/Doubleday, 2001
2.	Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd, 2009
3.	Ulrich & Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004.
4.	Kevin Otto, Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Pearson publications, 2001.
5.	All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
6.	3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
7.	The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.

SEMESTER – III

Course Code	Course Name	Semester	Credits	L T P C
	MATHEMATICS - III (PDE, Probability & Statistics)	**3**		3 1 0 4

COURSE OBJECTIVES

- To provide an overview of probability and statistical inferences to engineers
- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering

UNIT-I BASIC PROBABILITY **9**

Probability spaces, conditional probability, Independent random variables, sums of independent random variables, Bayes' Theorem, Discrete and Continuous one-dimensional random variables - Expectations, Moments, Variance of a sum, Moment generating function, Tchebyshev's Inequality.

UNIT-II PROBABILITY DISTRIBUTIONS **9**

Discrete Distributions – Binomial, Poisson and Negative Binomial distributions, Continuous Distributions - Normal, Exponential and Gamma distributions.

UNIT-III BASIC STATISTICS **9**

Measures of Central tendency: Averages, mean, median, mode, Measures of dispersion – Range, Mean deviation, Quartile deviation and Standard deviation, Moments, skewness and Kurtosis, Correlation and regression – Rank correlation.

UNIT-IV APPLIED STATISTICS **9**

Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations- Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

UNIT-V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **9**

Method of separation of variables – Vibration of a stretched string: Wave equation – Solution of Wave equation - D'Alembert's solution of wave equation – One dimensional heat flow – Solution of heat equation.

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	They understand the concept of basic probability, conditional probability and Baye's theorem and its application of analysis the Engineering problems.
2.	They Know to apply the discrete and continuous distributions in probability for the real life problems.
3.	They identify and improve their basic ideas of statistics including measures of central tendency, dispersion, correlation and regression.
4.	Analyzing the large and small samples using tools like z, t, F and chi-square.
5.	Design solution to PDE and to solve field problems in engineering involving PDEs.

TEXT BOOKS

1.	T. Veerarajan, Probability, Statistics and Random Processes, Third edition, Tata McGraw-Hill, New Delhi, 2017.
2.	S.P. Gupta, Statistical Methods, 46th edition, Sultan Chand & sons, New Delhi, 2021.
3.	Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

REFERENCES	
1.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2012.
2.	S. Ross, A First Course in Probability, 8th Ed., Pearson Education India, 2019.
3.	W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
4.	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 9th edition, 2016.

Mapping of COs with POs and PSOs													
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1	✓	✓											✓	
CO2	✓	✓											✓	
CO3	✓	✓		✓			✓				✓		✓	
CO4	✓	✓		✓			✓				✓		✓	
CO5	✓	✓		✓			✓				✓		✓	

Course Code	Course Name	Semester	Credits	L T P C
	ENGINEERING MECHANICS	3		3 0 0 3

COURSE OBJECTIVES

- To familiarize the basics laws of physics, vector operations and forces.
- To understand the principles of beams, supports and equilibrium of rigid bodies.
- To know the area and mass property calculations of various sections and solids.
- To study and analyse the dynamics of particles by various methods.
- To understand the applications of friction and rigid body dynamics.

UNIT-I STATICS OF PARTICLES **9**

Introduction – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces, Principle of transmissibility, Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Single equivalent force.

UNIT-II EQUILIBRIUM OF RIGID BODIES **9**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT-III PROPERTIES OF SURFACES AND SOLIDS **9**

Determination of Area and Volume – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moment of inertia.

UNIT-IV DYNAMICS OF PARTICLES **9**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse- Momentum principle – Impact of elastic bodies.

UNIT-V FRICTION AND RIGID BODY DYNAMICS **9**

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction-Ladder friction- Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of bodies.

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Get familiarized with the basic laws of physics, vector operations and forces.
2.	Understand the principles of beams, supports and equilibrium of rigid bodies.
3.	Calculate the area and mass properties of various sections and solids.
4.	Know about dynamics of particles and their analysis by various methods.
5.	Know about the applications of friction and rigid body dynamics.

TEXT BOOKS	
1.	Rajas Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., 3rd edition, Reprint 2011.
2.	Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, Tata McGraw-Hill International Edition, 2017, 12th edition.
REFERENCES	
1.	Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 14th edition, 2017.
2.	Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, 3rd edition, 2004.
3.	Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd.,(2008).
4.	Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).
5.	K.L. Kumar, "Engineering Mechanics" Tata McGraw-hill,, 4th Edition, 2017.
6.	S.S. Bhavikatti, " Engineering Mechanics", New Age International Publishers, 3rd edition, 2019.
7.	R. S. Khurmi, " Engineering Mechanics", S. Chand Publishers, 22nd edition, 2018.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√		√								√	√
CO2	√	√	√		√								√	√
CO3	√	√	√		√								√	√
CO4	√	√	√		√								√	√
CO5	√	√	√		√								√	√

Course Code	Course Name	Semester	Credits	L T P C
	ENGINEERING THERMODYNAMICS	3		3 0 0 3

COURSE OBJECTIVES

- To learn about the basic concepts of thermodynamics & first law of thermodynamics
- To learn about application of II law and to understand the concept of entropy/availability
- To evaluate the changes in properties of pure substances
- To understand various thermodynamic relations & ideal gas concept
- To learn about the concept of psychrometry

UNIT - I BASIC CONCEPTS AND FIRST LAW **9**

Concept of continuum- microscopic and macroscopic approach-Path and point functions - Properties – Thermodynamics system and their types - Thermodynamic Equilibrium - State, path and process - Quasi-static, reversible and irreversible processes - Modes of work - P-V diagram - Zeroth law of thermodynamics – Concept of temperature & heat - First law of thermodynamics - application to closed and open systems – steady and unsteady flow processes

UNIT- II SECOND LAW & AVAILABILITY ANALYSIS **9**

Statements of second law and its corollaries – Carnot theorem - Carnot cycle & Reversed Carnot cycle - Clausius inequality. Concept of entropy, entropy of ideal gas - Principle of increase in entropy. Applications of II Law. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency

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

Formation of steam & its thermodynamic properties - P-v, P-T, T-v, T-s, h-s diagrams. P-v-T surface. Use of Steam Table & Mollier Chart - Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles.

UNIT - IV IDEAL GAS & THERMODYNAMIC RELATIONS **9**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties. Compressibility factor- Generalized Compressibility Chart -. Simple Calculations.
Maxwell relations, Tds equations, Specific heat capacities - Energy equation - Joule-Thomson co-efficient, Clausius -Clapeyron equation – Third law of thermodynamics.

UNIT V PSYCHROMETRY **9**

Psychrometric properties - Psychrometric chart - Psychrometric processes – Adiabatic saturation - Sensible heating and cooling, humidification, dehumidification, Evaporative cooling and adiabatic mixing of air streams - Property calculations

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
2.	Apply second law of thermodynamics to open and closed systems and calculate entropy and availability
3.	Apply Rankine cycle to steam power plant and compare few cycle improvement methods.
4.	Derive simple thermodynamic relations of ideal and real gases.
5.	Calculate the properties of gas mixtures and moist air and its use in psychrometric processes.

TEXT BOOK

1.	Yunus A, Cengel & Michael A. Boles, "Thermodynamics – An Engineering Approach", McGraw Hill Education, 8th edition, 2017.

REFERENCES	
1.	Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2012.
2.	Borgnakke & Sonnatag, "Fundamental of Thermodynamics", John Wiley, 8th edition, 2016.
3.	Chattopadhyay P, "Engineering Thermodynamics", Oxford University Press, 2nd edition, 2016.
4.	J.P Holman, Thermodynamics – Tata McGraw Hill, 2019, 9th edition.
5.	Nag. P. K., "Engineering Thermodynamics", 6th edition, Tata McGraw-Hill, New Delhi, 2017.
6.	Vanwylen & Sonntag, Introduction to Thermodynamics, Classical & Statistical – Wiley Eastern, 2007, 4th edition.

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1	√	√	√			√						√		√
CO2	√	√	√			√						√		√
CO3	√	√	√			√						√		√
CO4	√	√	√			√						√		√
CO5	√	√	√			√						√		√

Course Code	Course Name	Semester	Credits	L T P C
	MANUFACTURING SCIENCE	3		3 0 2 4

COURSE OBJECTIVES

- To understand the concepts casting techniques.
- To understand the concepts of basic metal forming processes
- To understand the concepts of sheet metal forming processes
- To understand the various joining process.
- To understand the basic manufacturing concepts of plastic components

UNIT–I CASTING AND MOLDING **9**

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making– Working principle of Special casting processes – Shell, investment casting -die casting – Centrifugal casting – Sand Casting defects – Inspection methods

UNIT–II METAL FORMING PROCESSES **9**

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the process – Types of Forging Machines – Typical forging operations – Rolling of metals – Types of Rolling mills - Shape rolling operations – Defects in rolled parts - Principle of rod and wire drawing - Tube drawing –– Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion –– Equipment used

UNIT–III SHEET METAL FORMING **9**

Forming Operations- Blanking-blank size calculation, draw ratio, drawing force, Piercing, Punching, Trimming, Stretch Forming, Deep Drawing, Shearing, Metal Spinning, Bending, Tube bending, Tube forming -Embossing & Coining, Types of Dies, Progressive, Compound and Combination dies. Forming Methods - Explosive Forming, Electro Hydraulic Forming, Electro Magnetic Forming, Dynapack Machine, Rubber Forming, Super Plastic Forming.

UNIT–IV JOINING/FASTENING PROCESSES **9**

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding – Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes - Plasma arc welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering process – Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding.

UNIT–V MANUFACTURE OF PLASTIC COMPONENTS **9**

Types and characteristics of plastics — Moulding of thermoplastics — working principles and typical applications — injection moulding — Plunger and screw machines — Compression moulding, Transfer Moulding — Typical industrial applications — introduction to blow moulding –Rotational moulding — Film blowing — Extrusion — Thermoforming — Bonding of Thermoplastics

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	Study of moulding tools, equipment's, and furnaces
2.	Preparation of green sand moulding for cubical block, gland, bush, straight pipe, bend pipe, tee- pipe, grooved pulley, involving 2 boxes
3.	Sand testings – Permeability, green sand strength and compressibility.
4.	Metal casting techniques (demo only)
5.	Exercises in electric arc welding like Butt joint, Lap joint, Tee joint and fillet
6.	Gas welding and gas cutting – template cutting
7.	MIG and TIG welding
8.	Basic sheet Metal Operations
9.	Industrial Visit to Manufacturing Industry

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Apply the concepts of different metal casting processes, associated defects
2.	Gain the knowledge in various metal forming processes.
3.	Understand the sheet metal and forming processes.
4.	Understand the application of welding process
5.	Understand the different unconventional Manufacturing Methods employed for making different products.
TEXT BOOKS	
1.	Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014.
2.	Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley, 7th Edition, 2019.
3.	J.T. Black & Ronald A. Kohser, Degarmo's Materials and Processes in Manufacturing, John Wiley & Sons, 12th Edition 2017.
REFERENCES	
1.	Banga T.R, Agarwal. R.K. & Manghrani. T.M., "Foundry Engineering", Khanna Publishers, New Delhi, 1995.
2.	Jain.R.K. "Production Technology" Khanna Publishers, 17th edition, 2013.
3.	Bhattacharyya.A. "Metal Cutting Theory and Practice", Central Book Publishers, 1984.
4.	S. K. Hajra Chowdhery, & A. K. Hajra Chowdhery, Elements of Workshop Technology, Vol 1 & 2, Media Promoters and Publishers, 2007, 14th Edition.
5.	B.S. Magendran Parashar & R.K. Mittal,"Elements of Manufacturing Processes", Prentice Hall of India, 2003.
6.	P.N. Rao,"Manufacturing Technology",Tata McGraw-Hill Publishing Limited, 4th Edition, 2019.
7.	P.C. Sharma, "A text book of production technology",S. Chand and Company, 10th Revised Edition, 2010.

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1	√		√	√	√	√	√		√				√	
CO2	√	√	√	√	√	√	√		√				√	
CO3	√	√	√	√	√	√	√		√				√	
CO4	√		√	√	√	√	√		√				√	
CO5	√		√	√	√	√	√		√				√	

Course Code	Course Name	Semester	Credits	L T P C
	MATERIALS ENGINEERING	3		3 0 2 4

COURSE OBJECTIVES

- Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
- To provide a detailed interpretation of equilibrium phase diagrams.
- Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

UNIT-I CRYSTAL STRUCTURE **9**

Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

UNIT-II MECHANICAL PROPERTY MEASUREMENT **9**

Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength. Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, Introduction to nondestructive testing (NDT).

UNIT-III ALLOYS, SOLID SOLUTIONS AND PHASE DIAGRAMS **9**

Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-carbon phase diagram and microstructure aspects of ledeburite, austenite, ferrite and cementite, cast iron.

UNIT-IV HEAT TREATMENT OF STEEL **9**

Annealing, tempering, normalizing and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

UNIT-V METALS AND ALLOYS **9**

Introduction to Nano Materials Alloying of steel, properties of stainless steel and tool steels, maraging steels-cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminum and Al-Cu – Mg alloys- Nickel based super alloys and Titanium alloys.

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	Preparation of specimen, macro / micro etching techniques for metallographic examination
2.	Study and use of metallurgical microscope, different types and their operations
3.	Identification of plain and high carbon steel, quenched and tempered steel
4.	Identification of stainless steel – HSS and alloy steel.
5.	Identification of Grey C.I, White C.I, Malleable iron, SG iron.
6.	Identification of Cu alloys, Mg alloys, Al alloys, Ni alloys, Bearings metals
7.	Measurements of harden ability – Jomny end quench test
8.	Grain size measurement by comparison with ASTM chart
9.	Study of microstructure and hardness value before and after heat treatment such as annealing, normalizing, hardening and tempering.
10.	Demonstration of various sand testing methods (moisture determination, permeability testing, & green strength testing)

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Identify crystal structures for various materials and understand the defects in such structures.
2.	Understand how to tailor material properties of ferrous and non-ferrous alloys and how to quantify mechanical integrity and failure in materials
3.	Understand the micro structural aspects and phases of Fe-C systems.
4.	Understand the various heat treatment process.
5.	properties and applications of ferrous and non ferrous metals.
TEXT BOOKS	
1.	W. D. Callister, 2018, "Materials Science and Engineering-An Introduction", 10th Edition, Wiley India.
2.	Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
REFERENCES	
1.	V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 2015, 6th Edition.
2.	Jin U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 1st edition, 2011.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√					√			√	√	√	√
CO2	√	√	√	√			√		√	√	√	√	√	√
CO3	√					√					√	√	√	√
CO4	√		√		√	√	√	√	√	√	√	√	√	√
CO5	√						√			√	√	√	√	√

Course Code	Course Name	Semester	Credits	L T P C
	PROGRAMMING USING PYTHON LAB	3		1 0 2 2

COURSE OBJECTIVES

- Learn the syntax and semantics of the Python programming language
- Illustrate the process of structuring the data using lists, tuples and dictionaries.
- Demonstrate the use of file operations and searching pattern
- Interpret the concepts of Object-Oriented Programming as used in Python
- Appraise the need for working with various documents like Excel, PDF, Word and others file formats.

LIST OF EXPERIMENTS

1.	**Calculation of Test Average:** Write a python program to find the best of two test average marks out of three test's marks accepted from the user.
2.	**Palindrome Check & Digit Occurrence Count:** Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number.
3.	**Fibonacci sequence:** Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.
4.	**Binary to Decimal & Octal to Hexadecimal Conversion:** Develop a python program to convert binary to decimal, octal to hexadecimal using functions.
5.	**Sentence Statistics:** Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters.
6.	**String Similarity:** Write a Python program to find the string similarity between two given strings.
7.	**Insertion Sort & Merge Sort on lists:** Write a python program to implement insertion sort and merge sort using lists.
8.	**Check Phone Number:** Write a function called isphonenumber () to recognize a pattern 415-555-4242 without using regular expression and also write the code to recognize the same pattern using regular expression.
9.	**Search Phone Number & Email:** Develop a python program that could search the text in a file for phone numbers (+919900889977) and email addresses (sample@gmail.com)
10.	**File Operations:** Write a python program to accept a file name from the user and perform the following operations 1. Display the first N line of the file 2. Find the frequency of occurrence of the word accepted from the user in the file
11.	**Zip operation on a folder:** Develop a program to backing up a given Folder (Folder in a current working directory) into a ZIP File by using relevant modules and suitable methods.
12.	**Inheritance:** By using the concept of inheritance write a python program to find the area of triangle, circle and rectangle.
13.	**Employee Details:** Write a python program by creating a class called Employee to store the details of Name, Employee_ID, Department and Salary, and implement a method to update salary of employees belonging to a given department.
14.	**Polymorphism and Inheritance:** Write a python program to find the whether the given input is palindrome or not (for both string and integer) using the concept of polymorphism and inheritance.
15.	**Spreadsheet Operations:** Demonstrate python program to read the data from the spreadsheet and write the data in to the spreadsheet
16.	**Merge selected pages from Multiple PDFs to a new PDF:** Write a python program to combine select pages from many PDFs
17.	**Fetch weather data from the JSON:** Write a python program to fetch current weather data from the JSON file

CO	COURSE OUTCOMES
At the end of the course the student will be able to:	
1.	Understand Python syntax and semantics and be fluent in the use of Python flow control and Functions
2.	Develop, run and manipulate Python programs using Core data structures like Lists, Dictionaries, and use of Strings Handling methods.
3.	Develop, run and manipulate Python programs using File Operations and searching pattern using regular expressions.
4.	Interpret the concepts of object oriented programming using Python.
5.	Determine the need for scraping websites and working with CSV, JSON and other file formats.
REFERENCES	
1.	https://moodle.sit.ac.in/blog/python-programming-laboratory-21csl46/

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√		√							√	√	
CO2	√	√	√		√							√	√	
CO3	√	√	√		√							√	√	
CO4	√	√	√		√							√	√	
CO5	√	√	√		√							√	√	

SEMESTER - IV

Course Code	Course Name	Semester	Credits	L T P C
	ELECTRONICS ENGINEERING	4		3 0 0 3

COURSE OBJECTIVES

- To provide an overview of electronic device components to Mechanical engineering students.

UNIT-I SEMICONDUCTOR DEVICES AND APPLICATIONS **9**

Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

UNIT-II OPERATIONAL AMPLIFIER AND ITS APPLICATIONS **9**

Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

UNIT-III TIMING CIRCUITS AND OSCILLATORS **9**

RC-timing circuits, IC 555 and its applications as table and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

UNIT-IV DIGITAL ELECTRONICS FUNDAMENTALS **9**

Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

UNIT-V ELECTRONIC COMMUNICATION SYSTEMS **9**

The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Understand the principles of semiconductor devices and their applications.
2.	Design an application using Operational amplifier.
3.	Understand the working of timing circuits and oscillators.
4.	Understand logic gates, flip flop as a building block of digital systems.
5.	Learn the basics of Electronic communication system.

TEXT BOOKS

1.	Floyd ," Electronic Devices" Pearson Education 9th edition, 2015.
2.	R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 4th Edition, 2010.
3.	Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 15th Reprint, 2008.

REFERENCES

1.	Floyd ," Electronic Devices" Pearson Education 9th edition, 2015.
2.	R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 4th Edition, 2010.
3.	Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 15th Reprint, 2008.

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1	√	√			√								√	
CO2		√		√	√								√	
CO3	√	√			√								√	
CO4	√	√											√	
CO5	√				√					√			√	

Course Code	Course Name	Semester	Credits	L T P C
	THERMAL ENGINEERING	4		3 0 2 4

COURSE OBJECTIVES

- To apply the concept of thermodynamics to steam Nozzle & to understand the velocity triangle diagram of various turbines
- To understand the various systems of I.C. Engines
- To analyse the different gas power cycles
- The principles of reciprocating & rotary air compressors are studied
- To apply the concepts of thermodynamics to refrigeration & Air conditioning

UNIT- I FLOW THROUGH NOZZLE & STEAM TURBINES **9**

One-dimensional flow of steam through nozzle – Nozzle types - Critical pressure ratio – Nozzle efficiency - Super saturated flow in nozzles.
Impulse and Reaction turbine Principles - Compounding – Types - Velocity diagrams for simple and multistage turbines - Speed regulations – Governors.

UNIT-II I.C. ENGINES **9**

Classification – Working Principle - Components and their function. Valve timing & port timing diagram - actual and theoretical p-V diagram of four stroke and two stroke engines. Simple Carburettor Diesel pump and injector system - Ignition System - Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems. Performance calculations.

UNIT-III GAS POWER CYCLES **9**

Air Standard Cycles - Otto, Diesel, Dual & Brayton cycle Analysis – methods of cycle improvement. Regenerative, intercooled, reheated cycles and their combinations –Performance Calculations.

UNIT-IV AIR COMPRESSORS **9**

Reciprocating Air Compressors – Classifications - Working principle – work done - Effect of clearance volume - Single and multi-stage compressors, Volumetric efficiency – calculation of power requirement – Rotary compressors (Working Principle).

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

Refrigeration cycles- Reversed Carnot – Bell Coleman cycle - Vapour compression system –Super heating/Sub cooling - Vapour absorption refrigeration system- Properties of refrigerants. – Simple Problems on VCR system
Principles of air-conditioning - Types of A/C Systems –Industrial, Summer, Winter - Comfort and Year-round air conditioners – Window & Centralised A/C - Concept of GSHF – RSHF – ESHF.

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	Performance test on single stage reciprocating air compressor
2.	Performance test on constant speed centrifugal air blower
3.	Valve timing diagram on single cylinder four stroke petrol engine
4.	Port timing diagram on single cylinder two stroke petrol engine
5.	Performance test on high speed diesel engine with alternator loading
6.	Preparation of heat balance sheet on diesel engine
7.	Performance test on slow speed – diesel engine
8.	Performance test on twin cylinder diesel engine
9.	Noise and Smoke Measurement of diesel engine.
10.	Performance characteristic and Morse test on a multi cylinder petrol engine
11.	Testing of fuels and lubricants using Saybolt and Redwood viscometer
12.	Flash and fire point of fuels and lubricating oil.

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Analyse the problems of nozzles & turbines.
2.	Explain the functioning & features of I.C. Engines & Calculate the performance of I.C. Engines.
3.	Analyse & solve the problems of air standard cycles.
4.	Analyse the performance behaviour of single & multi stage reciprocating air compressors.
5.	Understand the different Refrigeration & A/C systems and solve the problems of VCR system.
TEXT BOOKS	
1.	Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, "Dhanpat Rai & sons , 2016
2.	Rajput. R. K., "Thermal Engineering" S. Chand Publishers, 2017
REFERENCES	
1.	Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers, 3rd edition, 2017.
2.	Ganesan V.." Internal Combustion Engines",4th Edition, Tata McGraw-Hill 2017.
3.	Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003.
4.	Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007.
5.	P. L. Ballaney, Thermal Engineering, Khanna Publishers, 2007, 24th Edition.

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1	√	√	√			√						√	√	
CO2	√	√	√			√						√	√	
CO3	√	√	√			√						√	√	
CO4	√	√	√			√						√	√	
CO5	√	√	√			√						√	√	

Course Code	Course Name	Semester	Credits	L T P C
	FLUID MECHANICS & MACHINERY	4		3 0 2 4

COURSE OBJECTIVES

- To understand the properties of fluids and concept of control volume.
- To understand the applications of the conservation laws to flow through pipes.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines.

UNIT-I FLUID PROPERTIES & FLOW CHARACTERISTICS **9**

Units and dimensions - Types of flows - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure – Gas laws - Surface tension and capillarity. Flow characteristics – concept of control volume – Bernoulli's Theorem – Concept of control volume – Application of continuity equation, energy equation, momentum equation and moment of 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**

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 triangles - Centrifugal pumps– Multi stage centrifugal pumps - working principle - work done by the impeller - performance curves – Priming – Cavitation - Reciprocating pump- working principle – Air vessels – Indicator diagram - Rotary pumps – Working Principles.

UNIT-V HYDRAULIC TURBINES **9**

Hydraulic turbines – Classification - working principles - Pelton wheel, Kaplan turbine - Francis turbine - velocity triangles - theory of draft tubes – Performance – Specific speed – Unit Quantities - Selection of turbines - governing of turbines - hydraulic coupling - Torque converter

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	Experimental Study of Bernoulli's Theorem
2.	Calibration of orifice meter, nozzle & Venturi Meter
3.	Flow through pipes and losses in pipes
4.	Flow through Notches
5.	Buoyancy experiment – Meta centric height
6.	Performance Characteristics of Centrifugal pump
7.	Performance Characteristics of Jet pump
8.	Performance Characteristics of Gear pump
9.	Performance Characteristics of Francis pump

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Apply mathematical knowledge to predict the properties and characteristics of a fluid.
2.	Analyse and calculate major and minor losses associated with pipe flow in piping networks.
3.	Mathematically predict the nature of physical quantities
4.	Analyse the performance of pumps
5.	Analyse the performance of turbines
TEXT BOOKS	
1.	K.L. Kumar, Engineering Fluid Mechanics, S. Chand Publishing, 2016.
2.	Modi P.N. & Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 23rd edition, 2022.
REFERENCES	
1.	S. K. Som, G. Biswas, S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2017, 3rd Edition.
2.	K. R. Arora, Fluid Mechanics Hydraulics and Hydraulic Machines, Standard Publishers, 2017, 9th Edition.
3.	C. P. Kothandaraman & R. Rudramoorthy. Fluid Mechanics and Machinery, New Academia Science, 2012, 3rd Edition.
4.	Douglas J.F, Solving Problems in Fluid Mechanics Vol I & II, John Wiley & Sons Inc., 3rd edition, 1996.
5.	Victor L. Streeter and E. Benjamin Wylie & Keith W.Bedford. Fluid Mechanics, Mc Graw-Hill 1999, 8th Edition.

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	√	√	√	√	√	√	√			√			√	√
CO2	√	√	√	√	√	√	√			√	√	√	√	√
CO3	√	√	√	√	√					√			√	√
CO4	√	√	√	√	√	√	√			√	√	√	√	√
CO5	√	√	√	√	√	√	√			√	√	√	√	√

Course Code	Course Name	Semester	Credits	L T P C
	MACHINE TOOLS AND METAL CUTTING	4		3 0 2 4

COURSE OBJECTIVES

- To understand the concepts metal cutting
- To provide knowledge on various types of lathes used
- To understand the difference between shaper planner and slotter in manufacturing domain
- To provide knowledge on different types of grinding machines and related tools for manufacturing various components
- To identify the basic gear manufacturing machines used in industries

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

Introduction, mechanics of metal cutting –Chip formation, Types of Chips, Cutting force calculations, Torque and Power Calculations in Machining, nomenclature of single point cutting tool, Tool materials, Influence of tool Geometry, Tool Life, machining time calculation, Machinability – evaluating and rating, metal cutting economics, problems in Merchant's circle, tool life, and machining time.

UNIT - II LATHE **9**

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, bar feed mechanism.

UNIT - III SHAPER, PLANER AND SLOTTER **9**

Introduction, types, specification, mechanism - holding devices, hydraulic drives in shaper, difference between shaper and planer.

UNIT - IV ABRASIVE PROCESSES **9**

Grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centreless grinding, internal grinding- micro finishing methods - Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines.
Introduction, types and specifications, mechanisms, holding devices, types of milling operation. Milling tool nomenclature and its specifications, Indexing – Types-Simple, Compounding and differentials.

UNIT - V GEAR MANUFACTURING PROCESSES **9**

Gear manufacturing processes - Gear Machining-Forming or Form cutting - Gear generating process-Gear shaping, Gear hobbing Gear planning, Gear broaching. Bevel gear generation.
Gear finishing process- Gear Finishing Methods – Gear Shaving, Gear Grinding, Gear lapping, Gear honing.

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	Study of lathe – types – accessories – capabilities and process – specification
2.	Lathe operation – plain & step turning, taper turning, grooving and under cutting, knurling, thread cutting (single, multi-start and internal), eccentric turning
3.	Exercise on drilling, reaming, boring & tapping
4.	Machining of plane and inclined surfaces, grooving, dovetail cutting using shaping machine.
5.	Cutting of spur, helical, bevel gear and milling of polygon surface using milling machine.
6.	Making of spur gear using gear Hobbing machine.
7.	Making of helical gear using gear Hobbing machine.
8.	Cutting of keyway (internal & external) using slotting machine
9.	Exercises involving cylindrical grinder
10.	Exercises involving surface grinder

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Understand the mechanics of metal cutting process
2.	Understand the various types of lathe machines
3.	Understand the shaper, planer and slotter machines
4.	Understand the application grinding operation in manufacturing
5.	Understand the gear manufacturing used in industries
TEXT BOOKS	
1.	Kalpakjian and Schmid, Manufacturing processes for engineering materials (6th Edition)-Pearson India, 2014.
2.	Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley, 5th Edition, 2013.
3.	Degarmo's Materials and Processes in Manufacturing, Black & Kohser, Wiley, 13th edition, 2021.
4.	Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promotors Pvt Ltd., Mumbai, 2005.
REFERENCES	
1.	B.S. Magendran Parashar & R.K. Mittal,"Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2.	P.N. Rao,"Manufacturing Technology",Tata McGraw-Hill Publishing Limited, 4th Edition, 2019.
3.	P.C. Sharma, "A text book of production technology",S. Chand and Company, 10th Revised Edition, 2010.
4.	Beddoes.J and Bibby M.J, 'Principles of Metal Manufacturing Processes', Elsevier, 2006.

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1	√	√	√	√	√							√	√	√
CO2	√	√	√	√	√							√	√	√
CO3	√	√	√	√	√							√	√	√
CO4	√	√	√	√	√							√	√	√
CO5	√	√	√	√	√							√	√	√

Course Code	Course Name	Semester	Credits	L T P C
	STRENGTH OF MATERIALS	4		3 0 2 4

COURSE OBJECTIVES

- To understand the nature of stresses developed in simple and composite bars.
- To understand the nature of stresses developed in beams.
- To understand the slope and deflection developed in beams.
- To calculate the elastic deformation occurring in various simple geometries for different types of loading.
- To understand the nature of stresses developed in cylinders and spheres for various types of simple loads.

UNIT - I SIMPLE STRESS AND STRAIN **9**

Deformation in solids– Hooke's law– stress and strain –tension, compression and shear stresses– composite bars - elastic constants and their relations–Volumetric, linear and shear strains.

UNIT - II SHEAR FORCE AND BENDING MOMENT DIAGRAM **9**

Beams and types–Transverse loading on beams– shear force and bend moment diagrams– Types of beam supports–Simply supported, over-hanging beams and cantilevers– Theory of bending of beams–bending stress distribution and neutral axis–shear stress distribution– point and distributed loads.

UNIT - III DEFLECTION OF BEAMS **9**

Deflection of a beam using double integration method, moment area method and macaulay's method– computation of slopes and deflection in beams–Maxwell's reciprocal theorems.

UNIT - IV TORSION OF SHAFT AND SPRINGS **9**

Torsion–Stresses and deformation in circular and hollow shafts– stepped shafts–Deflection of shafts fixed at both ends–Stresses and deflection of helical springs, laminated spring - principal stresses and principal planes– Mohr's circle.

UNIT- V THIN AND THICK CYLINDER **9**

Axial and hoop stresses in cylinders subjected to internal pressure–Deformation of thick and thin cylinders– Deformation in spherical shells subjected to internal pressure.

LIST OF EXPERIMENTS FOR LABORATORY COURSE

1.	Tensile test on MS rod and twisted bar (Electronic UTM)
2.	Comparison of hardness value of steel, copper and aluminium using Rockwell and Brinell hardness measuring machines
3.	Estimation of notch toughness of steel using impact testing machine
4.	Estimation of spring constant under tension and compression
5.	Tension test on MS wire (Tensile Testing Machine)
6.	Torsion test on mild steel rod.
7.	Deflection Test on Steel and Wooden Beam

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Recognize various types loads applied on machine components of simple and composite bars.
2.	Recognize the stresses developed on various types of beams.
3.	Recognize the slope and deflection developed on various types of beams.
4.	Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
5.	Understand the nature of internal stresses.

TEXT BOOKS	
1.	S. Ramamrutham and R. Narayan, Strength of Materials, Dhanpat Rai and Sons, New Delhi.2022, 20th Editon.
2.	L.S. Srinath, Advanced Mechanics of Solids, Tata McGraw HIll, 2017, 3rd Edition.
REFERENCES	
1.	Beer & Johnson, Mechanics of materials, SI Metric Edition, McGraw Hill, ISE, 17th edition, 2017.
2.	Gere and Timensenko, Mechanics of Materials, CBS Publishers, 7th edition, 2006.
3.	S.P. Timoshenko J.N Goodier, Theory of Elasticity, Mc Graw Hill International Edition, 3rd edition, 2017.
4.	S.M.A.Kazimi, Solid Mechanics, Tata McGraw Hill Publishing Company Ltd., First revised edition, 2006.
5.	Timoshenko & D.H. Young, J.V. Rao, Sukumar Pati, Engineering Mechanics, McGraw Hill, 5th edition, 2017.
6.	J. B. K Das & P.L. Srinivasa Murthy, Mechanics of Materials, Sapna Book House, 2018.

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	√	√	√	√								√	√	
CO2	√	√	√	√								√	√	
CO3	√	√	√	√	√							√	√	
CO4	√	√	√	√								√	√	
CO5	√	√	√	√								√	√	

Course Code	Course Name	Semester	Credits	L T P C
	PROGRAMMING USING MATLAB	4		1 0 2 2

COURSE OBJECTIVES

- Gaining a solid foundation in MATLAB programming and its applications in Solid Mechanics
- Gaining a solid foundation in MATLAB programming and its applications in Heat Transfer
- Gaining a solid foundation in MATLAB programming and its applications in Control Systems
- Gaining a solid foundation in MATLAB programming and its applications in Vehicle Dynamics
- Gaining a solid foundation in MATLAB programming and its applications in Automatic Transmission Simulation

LIST OF EXPERIMENTS

1.	To understand variables, arrays, matrices, and their operations
2.	To Learning about scripts, functions, loops, conditional statements, and control flow
3.	To solve linear and nonlinear equations using MATLAB
4.	To solving linear systems, Gaussian elimination, eigenvalues, and eigenvectors.
5.	Applying statistical methods for data analysis, including descriptive statistics, regression analysis, and hypothesis testing.
6.	Creating various types of plots (2D and 3D) to visualize data and results.
7.	Using MATLAB for simulation and modeling of mechanical systems and processes
8.	Modelling and simulating the behaviour of structures using MATLAB
9.	Analyzing heat transfer phenomena and solving heat transfer equations using MATLAB
10.	Designing and simulating control systems using MATLAB and Simulink
11.	Modelling and analyzing the dynamics of vehicles using MATLAB
12.	Coding and evaluating the performance of an automatic transmission in MATLAB

CO	COURSE OUTCOMES
Upon completion of this course, Students should be able to	
1.	Being able to implement various programming concepts in Solid Mechanics using MATLAB.
2.	Being able to implement various programming concepts in Heat Transfer using MATLAB.
3.	Being able to implement various programming concepts in Control Systems using MATLAB.
4.	Being able to implement various programming concepts in Vehicle Dynamics using MATLAB.
5.	Being able to implement various programming concepts in Automatic Transmission Simulation using MATLAB.

TEXT BOOK

1.	S. J. Chapman. MATLAB Programming for Engineers. Thomson, 4th edition, 2008.
2.	D. J. Higham and N. J. Higham. MATLAB Guide. Siam, second edition, 2005.
3.	A. Gilat. MATLAB: An introduction with Applications. John Wiley and Sons, 4th edition, 2012.
4.	D. Houcque. Applications of MATLAB: Ordinary Differential Equations. Internal communication, Northwestern University, pages 1–12, 2005.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√		√							√	√	
CO2	√	√	√		√							√	√	
CO3	√	√	√		√							√	√	
CO4	√	√	√		√							√	√	
CO5	√	√	√		√							√	√	