Course Code: **TME 101/ 201**   L T P C
Course Name: **BASIC MECHANICAL ENGINEERING**   **3 1 0 4**

UNIT 1

Properties of steam and Boilers: Steam formation. Types of steam. Steam properties –Specific Volume, Enthalpy and Internal energy (simple numerical problems). Steam boilers – classification, Lancashire boiler, Babcock and Wilcox boiler, Boiler mountings, Accessories, their locations and applications. (No sketches for mountings and accessories)

9 Hours

UNIT 2

Internal Combustion Engines: Classification, I.C. Engines parts, 2/4 – Stroke Petrol and 4- stroke diesel engines. P-V diagrams of Otto and Diesel cycles. Simple problems on Indicated power, Brake power, indicated thermal efficiency, Brake thermal efficiency, Mechanical efficiency and specific fuel consumption.

9 Hours

UNIT 3

Refrigeration and Air conditioning: Refrigerants, Properties of refrigerants, List of commonly used refrigerants. Refrigeration - Definitions - Refrigerating effect, Ton of Refrigeration, Ice making capacity, COP, Relative COP, Unit of Refrigeration. Principle and working of vapour compression refrigeration and vapour absorption refrigeration. Principles and applications of air conditioners, Room air conditioner.

6 Hours

UNIT 4

Lathe and Drilling Machines: Lathe - Principle of working of a centre lathe. Parts of a lathe. Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling, Taper turning, Specification of Lathe. Drilling Machine – Principle of working and classification of drilling machines, Operations on drilling machine - Drilling, Boring, Reaming, Tapping, Counter sinking, Counter boring and Spot facing.

Joining Processes: Soldering, Brazing and Welding: Definitions. Classification and method of Soldering, Brazing and welding and differences. Brief description of arc welding and Oxy-Acetylene welding.

10 Hours

UNIT 5

Power Transmission: Belt Drives - Classification and applications, Derivations of ratio of tensions. Definitions - Velocity ratio, Creep and slip, Idler pulley, stepped pulley and fast and loose pulley.

Gears: Definitions, Terminology, Types and uses. Gear drives and Gear Trains – Definitions and classifications, Simple problems.

8 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Elements of Mechanical Engineering	K.R. Gopalkrishna	Subhash Publishers, Bangalore		1234567153375
2	Elements of Mechanical Engineering	S. Trymbaka Murthy	I .K. International Publishing House Pvt. Ltd., New Delhi	3rd	978-93-80578-57-6

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	The Elements of Workshop Technology - Vol I and II	SKH Chowdhary,AKH Chowdhary	Media Promotors and Publishers, Mumbai	14th	8185099146, 9788185099149
2	Elements of Mechanical Engineering	Dr. A. S. Ravindra	Cengage Learning India	8th	8131514390 9788131514399

Course Code: **TME 102/ 202**   L T P C
Course Name: **ENGINEERING MECHANICS**   **3 1 0 4**

UNIT 1

Introduction to Engineering mechanics: Basic idealizations - Particle, Continuum and Rigid body; Force and its characteristics, types of forces, Classification of force systems; Principle of physical independence of forces, Principle of superposition of forces, Principle of transmissibility of forces; Newton's laws of motion, Introduction to SI units, Moment of a force, couple, moment of a couple, characteristics of couple, Equivalent force - couple system; Resolution of forces, composition of forces; Numerical problems on moment of forces and couples, on equivalent force - couple system.

7 Hours

UNIT 2

Composition of forces - Definition of Resultant; Composition of coplanar - concurrent force system, Principle of resolved parts; Numerical problems on composition of coplanar concurrent force systems. Composition of coplanar - non-concurrent force system, Varignon's principle of moments; Numerical problems on composition of coplanar non-concurrent force systems. Equilibrium of forces - Definition of Equilibrant; Conditions of static equilibrium for different force systems, Lami's theorem; Numerical problems on equilibrium of coplanar – concurrent and non concurrent force systems.

9 Hours

UNIT 3

Trusses: Introduction, simple force, determination of forces in simple truss members, method of joint and method of sections. Numerical problems.

Friction: Types of friction, Laws of static friction, Limiting friction, Angle of friction, angle of repose; Impending motion on horizontal and inclined planes; Wedge friction; Ladder friction; Numerical problems.

8 Hours

UNIT 4

Types of beams, supports and loadings, statically determinate beams, Numerical problems on support reactions for statically determinate beams.

Bending moment and Shear force in beams: Introduction, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (UDL) and couple for different types of beams.

11 Hours

UNIT 5

Centroid of plane figures; Locating the Centroid of triangle, semicircle, quadrant of a circle and sector of a circle using method of integration, Centroid of simple built up sections; Numerical problems. Moment of inertia of an area, polar moment of inertia, Radius of gyration, Perpendicular axis theorem and Parallel axis theorem; Moment of Inertia of rectangular, circular and triangular areas from method of integration; Moment of inertia of composite areas.

6 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Engineering Mechanics(Static and Dynamics)	Irving Herman Shames	Prentice Hall, 1997		0133569241, 9780133569247
2	Mechanics for engineers STATICS	Ferdinand P B and E.Russel Jhonston	McGraw-Hill Education, New Delhi	10th	0077402286 978-0077402280
3	Engineering Mechanics	Bhavikatti	New Age International Publisher, New Delhi	5th	8122437982 9788122437980
4	Engineering Mechanics	K L Kumar	McGraw-Hill Education, New Delhi	3rd	0070494738, 9780070494732

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Engineering Mechanics	S.Timoshenko, D.H.Young and J.V.Rao	McGraw-Hill Education, New Delhi	5th	ISBN-10 125906266X ISBN-13 9781259062667

Course Code: **PME 153/ 253**   L T P C
Course Name: **COMPUTER AIDED ENGINEERING GRAPHICS**   **2 0 3 2**

UNIT 1

Introduction to Computer Aided Sketching: Introduction, Drawing Instruments and their uses, BIS conventions, lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar, and description of most commonly used tool bars, navigational tools. Coordinate system and reference planes. Definitions of HP, VP, RPP and LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line convention, material conventions and lettering.

5 Hours

UNIT 2

Projections of points: Projections of points in all the four quadrants.

5 Hours

UNIT 3

Projection of lines: Projection of lines (located in first quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes (No application problems).

10 Hours

UNIT 4

Projection of Planes: Introduction, projection of planes, triangle, square, rectangle, rhombus, pentagon, hexagon, and circle, planes in different positions by change of position method only (No problems on punched plates and composite plates).

10 Hours

UNIT 5

Projection of Solids: Projection of Solids (first angle projection only) Introduction, projection of right-regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. (No problems on octahedrons and combination solids).

10 Hours

UNIT 6

Development of lateral Surfaces of Solids Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. Development of lateral surfaces of above solids, their frustums and truncations.

10 Hours

UNIT 7

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres and combination of solids (Maximum of two Solids).

10 Hours.

Note: Students will prepare two drawing sheets for every unit.

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	A primer on Computer Aided Engineering Drawing-2006		VTU, Belgaum		

2	Question bank and solutions on Computer Aided Engineering Drawing-2006		VTU, Belgaum.		
3	Engineering Graphics	K.R. Gopalakrishna	Subash Publishers Bangalore.	32nd	ISBN-13 EBK0012688

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Computer Aided Engineering Drawing	S. Trymbaka Murthy,	I.K. International Publishing house Pvt. Ltd., New Delhi,	3rd	**ISBN-10:** 9380578601 **ISBN-13:** 978-9380578606
2	Engineering Drawing	N.D. Bhatt and V.M. Panchal	Charotar publishing House, Gujarat	49th	8185594589, 9788185594583

Course Code: **PME 151/ 251**　　　　　　　　　　　　　　　　　　　　L T P C
Course Name: **WORK SHOP**　　　　　　　　　　　　　　　　　　　**0　　0 3 2**

Note : The jobs assigned in each shop (except Machine Shop), will be made as per drawing provided.

1. To file the given two Mild Steel pieces in to a square shape of 48 mm side

2. To make a ' V' Fitting Joint of mild steel of (50 mm x 50 mm x 5 mm thick).

3. To make a square Fitting Joint of mild steel of (50 mm x 50 mm x 5 mm thick).

4. To make dovetail joint from the given work pies to the required shape   and dimension.

5. To make T-Briddle Joint using a wooden piece.

6. To make Mortise and tenon joint using a wooden piece.

7. To make a Tap Dispencer out of sheet size 26 SWG .

8. To make a Square Tray out of sheet size 26 SWG.

9. To prepare a Butt Joint (single-V) through electric arc welding in flat position.

10. To prepare a T- Joint by electric arc welding.

11. To prepare a Lap joint by electric are welding.

12. To Make a Plane turning & Facing operation on the lathe machine .

13. To Make a step turning & Tapering operation on the lathe machine .

14. To Make a Threading operation on the lathe machine.

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	The Elements of Workshop Technology - Vol 1 and 2	S. K. H. Choudhury, A. K. H. Choudhury, Nirjhar Roy	Media Promoters and Publishers, Mumbai	14th	8185099146, 9788185099149
2	workshop technology vol 1 and 2	Raghuvanshi B S.	Dhanpat Rai	10th	ISBN-13 1234567144613

Course Code: **TMA 301**   L T P C
Course Name: **ENGINEERING MATHEMATICS**   **3 1 0 4**

UNIT 1
COMPLEX VARIABLES-I: Applications of complex variables in engineering, Function of a complex variable, Analytic functions, Cauchy – Riemann equations in Cartesian and polar forms, Properties of analytic functions.
                                                                                                                        8 Hours
UNIT 2
COMPLEX VARIABLES-II: Complex Integration, Cauchy Integral theorem, Cauchy Integral formula. Evaluation of Complex Integrals. Conformal Mappings: Translation, Magnification, Rotation, Inversion and Bi-linear Transformation.
                                                                                                                        9 Hours
UNIT 3
FINITE DIFFERENCES: Applications of numerical methods in Engineering, finite differences, Newton‟s divided difference formula. Lagrange‟s Interpolation and inverse interpolation formulae. Numerical differentiation using Newton‟s forward and backward interpolation formulae. Numerical Integration Simpson‟s one third and three eighth‟s, Weddle‟s rule. (All formulae / rules without proof).
                                                                                                                        9 Hours
UNIT 4
NUMERICAL METHODS: Numerical solutions of first order and first degree ordinary differential equations Taylor‟s series method, Picard‟s method Modified Euler‟s method, Runge-Kutta method of fourth order, Milne‟s predictor and corrector methods (All formulae without Proof).
                                                                                                                        8 Hours
UNIT 5
STATISTICS : RANDOM VARIABLE: Discrete and Continuous, Probability mass and Probability density Functions Bayes‟ Theorem and its applications, Moments, Moment Generating Functions and their properties, Binomial Poisson and Normal Distributions. Skewness, and Kurtosis. Correlation: Carl-Pearson coefficient and Spearman Brown‟s Rank correlation, Linear Regression.
                                                                                                                        8 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Engineering Mathematics	B.S. Grewal	Khanna Publishers	43rd	ISBN-10: 8174091955 ISBN-13: 978-8174091956
2	Higher Engineering Mathematics	B.V. Ramana	Tata-McGraw Hill	6th	ISBN-10: 007063419X ISBN-13: 978-0070634190

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Advanced Engineering Mathematics	Kreyszig, Erwin	Wiley Publications	10th	ISBN-10: 9780470458365 ISBN-13: 978-0470458365
2	A Text Book of Engineering Mathematics	Bali, N. P., Narayana Iyengar, N. Ch	Laxmi Publication, India	12th	8170083656, 9788170083658
3	Advanced Modern Engineering Mathematics	Glyn James	Pearson Education	4th	0130454257, 9780130454256

Course Code: **TME 302**   L T P C
Course Name: **MATERIAL SCIENCE AND METALLURGY**   **3 0 0 3**

UNIT 1
SIGNIFICANCE OF ENGINEERING MATERIALS
Classification of materials: Metals, Ceramics, Polymers, Composites. Advanced materials, smart materials
STRUCTURE OF CRYSTALLINE SOLIDS
Fundamental concepts of unit cell space lattice, Bravaias space lattices, unit cells for cubic structure and HCP, study of stacking of layers of atoms in cubic structure and HCP, calculations of radius, Coordination Number and Atomic Packing Factor for different cubic structures. Crystal imperfections-point, line, surface and volume defects. Diffusion, Diffusion Mechanism, Fick's laws of diffusion.   **8 Hours**

UNIT 2
MECHANICAL PROPERTIES
MAJOR MECHANICAL PROPERTIES OF METALS:
 Tensile properties, true stress and strain, Hardness, Rockwell, Vickess and Brinell Hardness testing. Plastic deformation, slip and twinning. **FRACTURE:** Types, stages in cup and cone fracture, Griffith''s criterion. Fatigue: fatigue tests, S-N curves, Factors affecting fatigue life and protection methods. Creep: The creep curves, Mechanisms of creep. Creep-resistant materials.   **8 Hours**

UNIT 3
SOLID SOLUTIONS: Types, Rules of governing the formation of solids solutions. Phase diagrams: Basic terms, phase rule, cooling curves, construction of phase diagrams, interpretation of equilibriums diagrams, Types of phase diagrams. Lever rule. Iron carbon equilibrium Diagram, phases in the Fe–C system, Invariant reactions, critical temperatures, Microstructure of slowly cooled steels, effect of alloying elements on the Fe-C diagram, ferrite and Austenite stabilizers. The TTT diagram, drawing of TTT diagram, TTT diagram for hypo- and hyper-eutectoid steels, effect of alloying elements.
                                                                             10 Hours

UNIT 4
ANNEALING: its types, normalizing, hardening, tempering, martemering, austempering, surface hardening like case hardening, carburizing, cyaniding, nitriding Induction hardening, hardenabilty, Jiminy end-quench test, Age hardening of Al and Cu alloys.
CORROSION AND ITS PREVENTION: Galvanic Cell, The Electrode Potentials, Polarization, Passivation, General methods of Corrosion Prevention, Cathodic Protection, Coatings, Corrosion Prevention by Alloying, Stress Corrosion Cracking.
                                                                             10 Hours

UNIT 5
ENGINEERING ALLOYS: Properties, composition and uses of low carbon, mild medium and high carbon steels. Steel designation and AISI –SAE designation. Cast irons, gray CI, white CI, malleable CI, SC iron. Microstructures of cast iron. The light alloys, Al and Mg and Titanium alloys. Copper and its alloys: brasses and bronze
                                                                             6 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Materials Science and Engineering-An Introduction	William D.Callister Jr.	Wiley India Pvt Ltd., New Delhi	7th	0471736961, 9780471736967
2	Essentials of Materials For Science And Engineering	Donald R. Askeland, Pradeep P. Phule Thomson	CL Engineering	1st	ISBN-10: 0534253091 ISBN-13: 978-0534253097

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Introduction to Material Science for Engineering	James F. Shackel Ford	Pearson, Prentice Hall, New Jersy	8th	ISBN10: 0133826651 ISBN-13: 978-0133826654
2	Physical Metallurgy, Principles and Practices	V Raghavan	PHI, New Delhi	2nd	ISBN10: 8120330129 ISBN-13: 978-8120330122
3	Foundation of Material Science and Engineering	William Fortune Smith, Javad Hashemi	McGraw Hill	5th	ISBN-10: 0073529249 ISBN-13: 978-0073529240

Course Code: **TME 303**   L T P C
Course Name: **MECHANICS OF MATERIALS**   3 1 0 4
UNIT 1
SIMPLE STRESS AND STRAIN: Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke‟s Law and Poisson‟s ratio, Stress-Strain relation – behaviour in Tension for Mild steel and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principles of super position.

6 Hours

UNIT 2
STRESS IN COMPOSITE SECTION: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars). **COMPOUND STRESSES:** Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr‟s circle for plane stress. Thick and thin cylinders: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame‟s equation). Strain energy.

8 Hours

UNIT 3
BENDING OF BEAMS: Beams, types and transverse loading on beams, shear force and bending moment in beams, Cantilever beams, Simply supported beams and over hanging beams.
BENDING AND SHEAR STRESSES IN BEAMS: Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, moment carrying capacity of a section, shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections.

11 Hours

UNIT 4
DEFLECTION OF BEAMS: Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay‟s method.

8 Hours

UNIT 5
TORSION OF CIRCULAR SHAFTS AND ELASTIC STABILITY OF COLUMNS: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts. Introduction to columns, Euler‟s theory for axially loaded elastic long columns, derivation of Euler‟s load for various end conditions, limitations of Euler‟s theory, Ranne‟s formula.

9 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Mechanics of Materials	R.C.Hibbeler K. S. Vijay Sekar	Pearson Education	9th	ISBN10: 0133254429 ISBN-13: 978-0133254426
2	Mechanics of Materials	James.M.Gere, Thomson	CENGAGE Learning Custom Publishing	8th	ISBN10: 1111577730 ISBN-13: 978-1111577735
3	Mechanics of Materials", S.I. Units	Ferdinand Beer and Russell Johnstan	TATA Mc GrawHill	7th	ISBN10: 0073398233 ISBN-13: 978-0073398235

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Strength of Materials	S.S.Bhavikatti	Vikas publications House – Pvt. Ltd.	3rd	8125927913, 9788125927914
2	Engineering Mechanics of Solids	Egor.P. Popov	Pearson Edu., India	2nd	9788177585780

Course Code: **TME 304**   L T P C
Course Name: **BASIC THERMODYNAMICS**   3 1 0 4

UNIT 1
FUNDAMENTAL CONCEPTS AND DEFINITIONS OF THERMODYNAMICS: Microscopic and Macroscopic approaches. System (closed system) and Control Volume (open system); Characteristics of system boundary and control surface. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, path and process, quasi-static process, cyclic and non-cyclic processes. Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium- Zeroth law of thermodynamics.

4 Hours

UNIT 2
WORK AND HEAT: Thermodynamics definition of work, examples, signs convention. Displacement work; expressions for displacement work in various processes through P-V diagrams. Heat; definition, units and sign convention, First Law of Thermodynamics: Joule‟s experiments, equivalence of heat and work. Statement of the First law of thermodynamics. Specific heat at constant volume, enthalpy, specific heat at constant pressure. Extension of the First law to control volume; steady state flow energy equation.

9 Hours

UNIT 3
SECOND LAW OF THERMODYNAMICS: Devices converting heat to work, Thermal reservoir. Direct heat engine; schematic representation and efficiency; reversed heat engine, schematic representation, coefficients of performance. Kelvin -Planck statement of the Second law of Thermodynamics; PMM-I and PMM-II. Clausius‟s statement of Second law of Thermodynamics; Equivalence of the two statements;

Reversible and irreversible processes; reversible heat engines, Carnot cycle, Carnot theorem, Thermodynamic temperature scale.

9 Hours

UNIT 4
ENTROPY: CLAUSIUS'S INEQUALITY: Entropy; definition, a property, principles of increase of entropy, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy. Availability and Irreversibility: - Maximum Work, maximum useful work for a system and a control volume, availability of a system and a steadily flowing stream, irreversibility. Second law efficiency.

10 Hours

UNIT 5
PURE SUBSTANCES: P-T and P-V diagrams, T-S and h-s diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

GAS MIXTURES: Ideal gas, Dalton‟s law of partial pressure, Internal energy, enthalpy, entropy and specific heats of gas mixtures.

THERMODYNAMIC RELATIONS: Maxwell‟s Equations, TdS equations, difference & ratio of heat capacities, Joule Kelvin effect, Clausius Clapeyron equation, third law of thermodynamics.

12 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Basic and Applied Thermodynamics	P .K. Nag	Tata McGraw Hill	4th	9780070260627
2	Thermodynamics an engineering approach	Yunus A. Cengel and Michael A. Boles	Tata McGraw hill	8th	ISBN-10: 0073398179 ISBN-13: 978-0073398174

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Engineering Thermodynamics	R.K.Rajput	Laxmi Publications	3rd	978-0-7637-8272-6
2	Engineering Thermodynamics	J.B. Jones and G.A.Hawkins	John Wiley and Sons	2nd	ISBN 10: 0471812021 ISBN 13: 9780471812029

Course Code: **TME 305**   L T P C

Course Name: **MANUFACTURING PROCESSES I**   **3 1 0 4**

UNIT 1

INTRODUCTION TO MANUFACTURING: Importance of manufacturing. Economic and technological considerations in manufacturing. Classification of manufacturing process and their relative merits and demerits. Materials and manufacturing processes for common items.

5 Hours

UNIT 2

FOUNDRY PRACTICES: Basic principle and survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand. Elements of mould and design considerations, Gating, Riser, Runner, Core. Solidification of castings. Sand casting, defects and remedies and inspection. Cupola furnace. Introduction to Die Casting.

10 Hours

UNIT 3

METAL FORMING PROCESSES: Metal Forming Fundamentals: Elastic and plastic deformation, yield criteria. Hot working vs cold working. Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction, sticking friction and mixed condition for slab. Work required for forging. Hand, Power and Drop Forging. Analysis of Wire drawing and maximum-reduction, Tube drawing, Extrusion and its applications. Condition for Rolling force and power in rolling. Rolling mills and rolled-sections. Defects in metal forming processes.

12 Hours

UNIT 4

PRESS WORKING: Presses and their classification, Die and punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs Piercing. Compound vs Progressive die. Flat-face vs Inclined-face punch and Load (capacity) needed. Analysis of forming process like cup/deep drawing. Bending and spring-back.

8 Hours

UNIT 5

POWDER METALLURGY: Powder metallurgy manufacturing process. The need, process, advantage and applications.

JIGS & FIXTURES: Locating and clamping devices and principles. Jigs and Fixtures and its applications.

PLASTICS: Manufacturing of plastic components, Review of plastics, and its past, present and future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic and its applications. Resins and Adhesives.

7 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Manufacturing Science	Ghosh and Mallik	East-West Press Pvt. Ltd.	2nd	ISBN-10 8176710636 ISBN-13 9788176710633
2	Production Engg. Science	P.C. Pandey & C.K.Singh	Standard Publishers Distributors	7th	8186308954, 9788186308950

S.No.	Title	Author	Publication	Edition	ISBN
3	Production Technology	R.K. Jain	Khanna Publishers	17th	8174090991, 9788174090997

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Manufacturing Technology	P.N. Rao.	TMH	4th	ISBN10: 1259062570 ISBN-13: 978-1259062575
2	Materials and Manufacturing	Paul Degarmo	Wiley	9th	ISBN-10: 0471656534 ISBN-13: 978-0471656531
3	Manufacturing Engineering and Technology	Kalpakjian	Pearson Pubublication	7th	ISBN10: 0133128741 ISBN-13: 978-0133128741

Course Code: **PME 311**   L T P C
Course Name: **COMPUTER AIDED MACHINE DRAWING**   **0 0 5 4**

INTRODUCTION: Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing. Drawing units, grid and snap.

<div align="center">PART – A</div>

UNIT 1

SECTIONS OF SOLIDS: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.

ORTHOGRAPHIC VIEWS: Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.

UNIT 2

THREAD FORMS: Thread terminology, sectional views of threads. ISO Metric (Internal and External) BSW (Internal and External) square and Acme. Sellers thread, American Standard thread.

FASTENERS: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

<div align="center">PART – B</div>

UNIT 3

KEYS AND JOINTS: Parallel key, Taper key, Feather key, Gib head key and Woodruff key

RIVETED JOINTS: single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets).cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

UNIT 4

COUPLINGS: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham''s coupling and universal coupling (Hooks'' Joint)

<div align="center">PART – C</div>

UNIT 5

ASSEMBLY DRAWINGS (Part drawings should be given)

        1. Plummer block (Pedestal Bearing)   6. Machine vice
        2. Petrol Engine piston   7. Tool Head of shaper
        3. I.C. Engine connecting rod
        4. Screw jack (Bottle type)
        5. Tailstock of lathe

<div align="center"><i><u>Note: Students will prepare two drawing sheets for every unit.</u></i></div>

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	A Primer on Computer Aided Machine Drawing-2007		VTU, Belgaum		
2	Machine Drawing	N.D.Bhat and	CHAROTAR PUBLISHING	53rd	ISBN-10: 9380358962

<div align="center">Graphic Era Hill University, Dehradun/Bhimtal</div>

S.No.	Title	Author	Publication	Edition	ISBN
		V.M.Panchal	HOUSE PVT.LTD.		ISBN-13: 978-9380358963
3	Machine Drawing	N. Siddeshwar, P. Kanniah, V.V.S. Sastri	Tata Mc GrawHill		ISBN10: 007460337X ISBN-13: 978-0074603376

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	A Text Book of Computer Aided Machine Drawing	S. Trymbaka Murthy	CBS Publishers	2nd	ISBN-10: 8123916604 ISBN-13: 9788123916606
2	Machine Drawing	K.R. Gopala Krishna	Subhash Publication	1st	
3	Machine Drawing with Auto CAD	Goutam Pohit and Goutham Ghosh	Pearson Education	1st	ASIN: B00AE3T7ZM
4	Auto CAD 2006, for engineers and designers	Sham Tickoo	Dream tech 2005.		

Course Code: **PME 312** `   L T P C

Course Name: **METALLOGRAPHY AND MATERIAL TESTING LAB**   **0 0 3 2**

1. Tensile test of metallic and nonmetallic specimens using a Universal Testing Machine

2. shear test of metallic and nonmetallic specimens using a Universal Testing Machine

3. Compression test of metallic and nonmetallic specimens using a Universal Testing Machine.

4. Preparation of specimen for Metallographic examination of different engineering materials.

5. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze and composites.

6. Heat treatment: Annealing and hardness studies of heat-treated samples.

7. Heat treatment: normalizing and hardness studies of heat-treated samples.

8. Heat treatment: tempering and hardness studies of heat-treated samples.

9. Brinell hardness test.

10. Rockwell hardness test.

11. Sample preparation for Izod and Charpy tests on M.S. Specimen.

12. Izod and Charpy tests on M.S. Specimen.

13. Torsion test on torsion testing machine.

14. Bending Test on metallic and nonmetallic specimens.

Course Code: **PME 313**   L T P C
Course Name: **FOUNDRY AND FORGING LAB**   **0 0 3 2**

1. Preparation of casting mould using two moulding boxes by using pattern (simple type).

2. Preparation of casting mould using split type pattern.

3. Preparation of casting mould using gear pattern.

4. To demonstrate the casting process (Aluminum parts).

5. To determine grain fineness number of a given sand sample (Sieve Analysis Test).

6. To prepare the upset forging process to make a simple parts.

7. To perform forging operation of a sample by using power hammer.

8. To determine amount of clay content in a given sand sample.

9. To determine moisture content in a given sand sample by rapid moisture teller.

10. To determine moisture content in a given sand sample by evaporation method.

11. To perform permeability test for a given sand sample.

12. To perform compression, shear and tensile test of a given sand sample in universal Sand Testing Machine.

13. To determine hardness of core by testing.

14. To determine hardness of mould by testing.

Course Code: TME 401   **L T P C**
Course Name: APPLIED THERMODYNAMICS   **3 1 0 4**

UNIT 1

GAS POWER CYCLES: Air Standard Cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-v and T-s diagrams, description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles. GAS TURBINES AND JET PROPULSION: Classification of Gas Turbines, Analysis of open cycle gas turbine cycle. Advantages and Disadvantages of closed cycle. Methods to improve thermal efficiency. Jet Propulsion and Rocket propulsion.   **10 Hours**

UNIT 2

VAPOUR POWER CYCLES: Carnot vapor power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T-S diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapor power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle
                                                                                             9 Hours

UNIT 3

RECIPROCATING COMPRESSORS: Operation of a single stage reciprocating compressors. Work input through P–V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multi-stage compressor, saving in work, optimum intermediate pressure, inter-cooling, minimum work for compression.

                                                                                             8 Hours

UNIT 4

STEAM CONDENSERS: Steam condensers introduction, types of condensers, back pressure and its effect on plant performance air leakage and its effect on performance of condensers, cooling towers and heat exchangers, various types of cooling towers, design of cooling towers.

                                                                                             7 Hours

UNIT 5

I.C. ENGINES: Introduction to I.C engines and their working, difference, Testing of two-stroke and four-stroke SI and CI engines for performance, related numerical problems, heat balance, Morse test.

STEAM NOZZLES: Introduction, types of nozzles, flow of steam through nozzles, expansion of steam considering friction, supersaturated flow through nozzle, general relationship between area, velocity and pressure in nozzle flow.   **10 Hours**

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Basic and Applied Thermodynamics	P.K.Nag	Tata McGraw Hill Pub	8th	007047
2	Fundamental of Classical Thermodynamics	G.J. Van Wylen and R.E.Sonntag	Wiley Eastern	8th	
3	Thermodynamics- An Engineering Approach, ,	Yunus, A.Cenegal and Michael A.Boles	Tata McGraw Hill Pub. Co.		ISBN 10: 0070681139 ISBN 13: 9780070681132

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	A course in Thermal Engineering	Domkundwar, Kothandaraman and Domkundwar	Dhanpat Rai & Co.		ASIN: B005TCTI8E
2	Applied Thermodynamics	R.K.Hegde and Niranjan Murthy	Sapna Book House.		ISBN: EBK00OLD25 ISBN-13:EBK00OLD25

L T P C

Course Code: **TME 402**
Course Name: **INDUSTRIAL ENGINEERING**   **3   0   0   3**

UNIT 1

Introduction to production. Difference between production and manufacturing.
PRODUCTIVITY: Definition of productivity, factors affecting productivity definition, objective and scope of productivity.
PLANT LOCATION and LAYOUT: Plant layout, location, factors affecting the choice of location, Objectives of Plant layout, Influencing factors of plant layout, Types of Plant layout, Advantages of Good layout, Factors effecting plant location, selection criteria of plant site. Plant location advantages and disadvantages in rural, urban and semi urban areas.
LINE BALANCING: Assembly lines, need and shapes of assembly lines, Line balancing problems, Cycle Time and idle time calculations, Introduction to Line balancing.

8 Hours

UNIT 2

WORK STUDY: Introduction, Human factors in work study, work study and management, work study and supervisor, work study and worker.

METHOD STUDY: Definition, objective and scope of method study, activity recording and exam aids. Charts to \ record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts. Introduction to motion economy. Principles ofmotion economy, classification of moments two Handed process chart, SIMO chart, and micro motion study.

TIME STUDY: Time Study, Time Study Method, Rating and standard Rating, standard performance, scale of rating, factors of affecting rate of working, allowances and standard time determination. Predetermined motion time study – Method time measurement (MTM).

9 Hours

UNIT 3

INTRODUCTION TO WORK MEASUREMENT: Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling need.

ERGONOMICS: Introduction, areas of study under ergonomics, system approach to ergonomics Model, man-machine system. Components of man-machine system and their functions – work capabilities of industrial worker, study of development of stress in human body and their Consequences. Computer based ergonomics.

9 Hours

UNIT 4

MATERIALS MANAGEMENT: Objectives and functions, Purchasing function, Purchasing procedure, ABC analysis, Make or buy decisions, simple break even analysis, Obsolete, Scrap and surplus management.
MATREIAL HANDLING SYSTEMS: Introduction to material handling, need and basic principles of material handling, Material handling equipment"s.
INVENTORY CONTROL: Introduction, need and types of inventory control, types of inventory.
SUPPLY CHAIN MANAGEMENT : Introduction, need of supply chain management, Basic supply chain networks.

10 Hours

UNIT 5

SCHEDULING AND FORECASTING: Introduction to scheduling, methods of scheduling, need of Forecasting, methods of forecasting.
ESTIMATING and COSTING : Estimating definition, importance, functions. Costing- definition,

aims, difference between estimating and costing, procedure of costing, Classification of costs,

Elements of Costs- direct and indirect Material costs, direct and indirect Labour costs, prime cost, factory cost, Man Hour rate, Machine Hour rate, Unit rate method.

8 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Industrial Engineering	Mahajan and Sahani	Dhanpat Rai Publication	2nd	ISBN-10: 8177000470 ISBN-13: 9788177000474
2	Industrial Engineering	Martand Telseng	S. Chand Publication	2nd	ISBN-10: 8121917735 ISBN-13: 9788121917735
3	Mechanical estimating and Costing	T R banga, S C Sharma,	Khanna Publishing house	16th	ISBN-13 978-81-7409-266-3 ISBN-10 81-7409-266-3
4	Work study	George Kanawaty	ILO	4th	9221071081

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Human Factors in Engineering	S Sanders and E J McCormick	Mc Graw Hill	6th	007054901X ISBN 13: 9780070549012
2	Work Study and Ergonomics	S Dalela and Sourabh	Standard Publishers and Distributers, Delhi	3rd	
3	Industrial Engineering Hand book	Maynard	Mc Graw-Hill Professional	5th	0070411026/ 978007041129
4	Modern Production Control	Buffa and Sarin	John Wiley & sons	8th	8126513721, 9788126513727
5	Motion and Time study	Ralph M Barnes	John Wiley	7th	978-0-471-05905-9

Course Code: **TME 403**   L T P C
Course Name: **MANUFACTURING PROCESSES-II**   **3   1 0 4**

UNIT 1

INTRODUCTION TO METAL CUTTING: Theory Of Metal Cutting: Single point cutting tool nomenclature, geometry, Merchants circle diagram and analysis, Ernst Merchant''s solution, shear angle relationship, problems of Merchant's analysis, tool wear and tool failure, tool life, effects of cutting parameters on tool life, tool failure criteria.

6 Hours

UNIT 2

CUTTING TOOL MATERIALS: Desired properties, types of cutting tool materials – HSS, carbides coated carbides, ceramics. Taylor's tool life equation, problems on tool life evaluation. Cutting Fluids: Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and W/P. Measurement of tool tip temperature.

10 Hours

UNIT 3

BASICS OF GENERAL PURPOSE MACHINE TOOLS: Turning (Lathe): Classification, constructional features of turret and capstan lathe, tool layout, driving mechanisms of lathe, operations on lathe Taper turning, knurling and facing etc. **Drilling Machines**: Classification, constructional features, drilling and related operations, types of drill and drill bit nomenclature, drill materials. **Milling Machines**: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. **Indexing of Machine Mechanisms:** Simple, compound, calculations. on Simple problems on simple and compound indexing.

10 Hours

UNIT 4

BASICS OF GENERAL PURPOSE MACHINE TOOLS (CONTD.): Shaper And Planer Machines: Classification, constructional features, nomenclature of tooling, operation and comparison of both. Operations on shaper and Planer machines. **Grinding Machines:** Types of abrasives, bonding process, classification, constructional features as cylindrical grinding, Center less grinding and surface grinding, selection of grinding wheel. **Lapping And Honing Machines**: Principles of operation, construction, applications.

6 Hours

UNIT 5

CONVENTIONAL WELDING & ALLIED PRACTICES: Survey of Welding processes, Classification of welding processes, position of welding, joint types Gas welding: process and equipment details, Gas cutting, process and equipment details, flame types ; Arc welding: process and equipment details, power sources, electrode details. ; TIG and MIG processes and their parameters, RESISTANCE WELDING: types and details, atomic hydrogen, submerged arc ,electro slag, friction welding, soldering and brazing, Thermodynamics and metallurgical aspects in welding shrinkages, distortions, residual stresses generation in HAZ and remedies, defects in welding and remedies.

10 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Manufacturing Engineering & Technology	Kalpakjian and Schmid.	Pearson	7th	ISBN-10: 0133128741 ISBN-13: 978-0133128741

2	Manufacturing Processes Vol.II	P N Rao	TMH	4th	ISBN-10: 1259062570 ISBN-13: 978-1259062575
3	Production Technology	HMT	Tata MacGraw Hill		0070964432, 9780070964433

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Manufacturing Science	Amitabha Ghosh and Mallik	East West Press	2nd	ISBN-10 8176710636 ISBN-13 9788176710633
2	Fundamentals of Metal Machining and Machine Tools	G. Boothroyd,	CRC Press	3rd	0824778529, 9780824778521
3	Materials and their Processing	Paul De Garmo and Black	Wiley	9th	ISBN10: 0471656534 ISBN-13: 978-0471656531
4	Machining Science	G K Lal	New Age International	3rd	ISBN-10: 8122421040 ISBN-13: 978-8122421040

Course Code: **TME 404**   L T P C
Course Name: **MEASUREMENTS AND METROLOGY**   **3 1 0 4**

UNIT 1
MEASUREMENT AND METROLGY: Introduction, Principle of Measurement, Concept of Error, Source of Error, Error Measurement.

System of Measurement, Imperial Standard Yard, Wavelength Standard, Line and End Measurement.
Sensors and Transducer: Types of Sensors, Types of Transducer and Their Characteristics.

                                                                      6 Hours

UNIT 2
LINEAR AND ANGULAR MEASUREMENT: Vernier Calliper, Principle of Micrometer, Slip Gauges, Bevel Protractor, Sine Bar, Clinometer, Optical Square.
COMPARATORS: Introduction, Basic Principle of Operation, Mechanical Comparators, Dial Gauge, Johnson Mikrokator. Principle of Optical Comparator, Zeiss Ultra Optimeter, Pneumatic Comparators.

                                                                       9 Hours

UNIT 3
SCREW THREAD MEASUREMENT: Screw Thread Terminology, Measurement of Various Elements of Thread, Measurement of Pitch Diameter by 2 wire and 3 wire Methods, Best Wire Size, and Tool Makers" Microscope.
MEASUREMENT AND MEASUREMENTS SYSTEM: Methods of Measurement, Performance Characteristics of Measuring Devices-Static and Dynamics.

                                                                       9 Hours

UNIT 4
METROLOGY AND INSPECTION: Limit, Fit and Tolerance, Types of Assemblies, Principle of Interchangeability.
TYPES OF GAUGES: Limit Gauge, Gap Gauge, Plain Plug Gauge, Ring Gauge, Snap Gauge, Taylor"s Principle of Gauge Design.

                                                                       9 Hours

UNIT 5
MEASUREMENT OF FORCE, TORQUE AND PRESSURE: Hydraulic Pneumatic Load Cells, Prony Brake, Hydraulic Dynamometer, Bourdon Tube, McLeod Gauge.
TEMPERATURE MEASUREMENT: Resistance Thermometer, Bimetallic Thermocouples-Principle, Working, construction. Pyrometer-Principle, Optical Pyrometer.
STRAIN MEASUREMENT: Types of Strain Gauges, Strain Rosette, Calibration of Strain Gauge.

                                                                       9 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Mechanical measurements	Beckwith Marangoni and Lienhard	Pearson Education	6th	8131717186, 9788131717189
2	Engineering Metrology	R.K.Jain	Khanna Publishers	21st	ISBN 10: 81-7409-153-X ISBN 13: 978-81-7409-153-X

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Engineering Metrology	I.C.Gupta	Dhanpat Rai Publications, Delhi	8th	ISBN 10: 4567144031 ISBN 13: 1234567144039
2	Mechanical measurements	R.K.Jain	Khanna Publishers	12th	ISBN 10: 81-7409-191-2 ISBN 13: 978-81-7409-191-2
3	Measurement Systems Applications and Design	Ernest O, Doblin	McGRAW Hill Book	4th	ISBN 10: 0070173389 ISBN 13: 978-0070173385

Course Code: **TME 405**   L T P C
Course Name: **KINEMATICS OF MACHINES**   **3 1 0 4**

UNIT 1

INTRODUCTION: DEFINITIONS: Link or element, kinematic pairs, degrees of freedom, Grubler"s criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine.

KINEMATIC CHAINS AND INVERSIONS: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

MECHANISMS: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.Straight line motion mechanisms –Peaucellier"s mechanism and Robert"s mechanism. Intermittent Motion mechanisms –Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism

11 Hours

UNIT 2

VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS (GRAPHICAL METHODS)
Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.
VELOCITY ANALYSIS BY INSTANTANEOUS CENTER METHOD: Definition,Kennedy"s
Theorem, Determination of linear and angular velocity using instantaneous center method
KLEIN'S CONSTRUCTION: Analysis of velocity and acceleration of single slider crank Mechanism.

11 Hours

UNIT 3

VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS (ANALYTICAL METHODS):
Analysis of four bar chain and slider crank chain using analytical expressions (use of complex algebra and vector algebra).

5 Hours

UNIT 4

SPUR GEARS: Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of in volute and cycloid teeth.

GEAR TRAINS: Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

9 Hours

UNIT 5

CAMS: Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

6 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Theory of Machines	Rattan S.S	Tata McGraw-Hill Publishing Company Ltd., New Delhi	4th	ISBN 10: 9351343472 ISBN 13: 978-9351343479
2	Theory of Machines	Sadhu Singh	Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi	3rd	9332509786, 9789332509788

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Theory of Machines and Mechanisms	Shigley. J. V. and Uickers, J.J.	OXFORD University press		ISBN 10: 0195371232 ISBN 13: 978-0195371239
2	Theory of Machines –I	A.S.Ravindra	Sudha Publications	1st	ISBN 10: 4567157850 ISBN 13: 1234567157850

Course Code: **PME 411**   L T P C
Course Name: **MACHINE SHOP**   **0 0 3 2**

1. Lathe operations: To perform plain turning, step turning and facing on a given specimen.

2. To perform taper turning, thread cutting and knurling on a given specimen.

3. Groove/ slot cutting on Milling machine.

4. Cutting of V Groove using a shaper.

5. Cutting of dovetail using a shaper.

6. Finishing of a given surface on surface-grinding machine.

7. Drilling a hole and Counter drilling operation on a given specimen.

8. Designing a Jig for a given component.

9. Designing a Fixture for a given component.

10. Performing Arc welding on a specimen.

11. Performing Resistance Spot welding on a specimen.

12. Performing GAS welding on a specimen.

13. Performing TIG welding on a specimen.

14. Performing MIG welding on a specimen.

15. Performing GAS cutting on a specimen.

Course Code: **PME 412**   L T P C
Course Name: **APPLIED THERMODYNAMICS LAB**   **0   0 3 2**

1. To determine specific fuel consumption in three cylinder four stroke petrol engine.

2. To determine brake horse power in three cylinder four stroke petrol engine.

3. To determine brake thermal efficiency & mechanical efficiency in three cylinder four stroke petrol engine.

4. To determine indicated thermal efficiency in three cylinder four stroke petrol engine.

5. To perform Morse test in three cylinder four stroke petrol engine.

6. To determine specific fuel consumption in single cylinder four stroke water cooled diesel engine.

7. To determine Brake horse power in single cylinder four stroke water cooled diesel engine.

8. To determine Volumetric efficiency in single cylinder four stroke water cooled diesel engine.

9. To determine Brake thermal efficiency in single cylinder four stroke water cooled diesel engine.

10. To determine Brake power and fuel consumption in single cylinder two stroke petrol engine.

11. To determine specific fuel consumption and brake thermal efficiency in single cylinder two stroke petrol engine.

12. To find the dryness fraction of steam by using a separating and throttling calorimeter.

13. To calculate co-efficient of performance- (cop) by using a refrigeration test rig (vapour absorption system).

14. To calculate co-efficient of performance- (cop) by using air-conditioner test rig (vapour compression system) and draw the p-h curve.

Study and demonstration of Different Cut Section associated with theory curriculam.

1. Demonstration of constructional features and working of cochran and babcok and wilcox boilers.

2. Demonstration of constructional features and working of lancashire boiler.

3. Demonstration of various mountings and accessories of steam boilers.

4. Demonstration of various types of Compression Ignition and Spark Ignition engine.

Course Code: **PME 413**   L T P C
Course Name: **MEASUREMENT and METROLOGY LAB**   **0 0 3 2**

1.   Linear measurement using Vernier caliper/Digital V. caliper

2.   Linear measurement using Micrometer

3.   Angular measurement by using Sine Bar

4.   Angular measurement by using Bevel Protector

5.   Working of dial gauge

6.   Calibration of Load Cell

7.   Calibration of Pressure Gauge

8.   Calibration of Thermocouple

9.   Calibration of LVDT

10.   Determination of modulus of elasticity of a mild steel sample using strain gauges.

11.   Calibration of micrometer using slip gauges

12.   Measurement of gear tooth profile using gear tooth Vernier / gear tooth micrometer

13.   Measurement using optical flats

14.   Measurement of cutting tool forces using

15.   a) Lathe tool dynamometer

       b) Drill tool dynamometer

Course Code: **TME 501**   L T P C
Course Name: **HEAT AND MASS TRANSFER**   **3 1 0 4**

UNIT 1

INTRODUCTORY CONCEPTS AND DEFINITIONS: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer.
resistance concept & its importance. Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Analogy of Heat flow rate with electric current flow. Introduction to unsteady state heat transfer.

CONCEPTS AND BASIC RELATIONS IN BOUNDARY LAYERS: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number.

10 Hours

UNIT 3

FREE OR NATURAL CONVECTION: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations of free convection in vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres,

FORCED CONVECTIONS: Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers.

9 Hours

UNIT 4

HEAT EXCHANGERS: Classification of heat exchangers; overall heat transfer coefficient, LMTD, Effectiveness-NTU methods of analysis of heat exchangers.

CONDENSATION AND BOILING: Types of condensation, Nusselt''s theory for laminar condensation on a vertical flat surface; regimes of pool boiling, pool boiling correlations. Mass transfer definition and terms used in mass transfer analysis, Ficks First law of diffusion

10 Hours

UNIT 5

RADIATION HEAT TRANSFER: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzmann law, Kirchhoff''s law, Planck''s law and Wien''s displacement law.

Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; radiation heat exchange between two finite surfaces-configuration factor or view factor.

5 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Heat and Mass transfer	Tirumaleshwar	Pearson education	2nd	8177585193, 9788177585193
2	Heat transfer-A basic approach	Ozisik	Tata Mc Graw Hill		0070479828, 9780070479821

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Heat transfer, a practical approach	Yunus A-Cengel	Tata Mc Graw Hill	2nd	ISBN 10: 0072458933 ISBN 13: 978-0072458930
2	Principles of heat transfer	Frank Kreith	C L Engineering	7th	ISBN 10: 0495667706
3	Fundamentals of heat and mass transfer	Frenk P. Incropera and David P. Dewitt	John Wiley and son''s.	7th	978-0-470-91323-9
4	Heat transfer	P.K. Nag	Tata Mc Graw Hill 2002.	3rd	ISBN 10: 0070702535 ISBN 13: 978-0070702530

Course Code: **TME 502**   L T P C
Course Name: **UNCONVENTIONAL MANUFACTURING PROCESSES**   **3 0 0 3**

UNIT 1

INTRODUCTION TO UNCONVENTIONAL MANUFACTURING PROCESSES: Need of unconventional manufacturing processes, Classification of unconventional manufacturing processes, Hybrid processes.

ADVANCED CASTING PROCESSES: Introduction, Centrifugal casting. Investment casting, Stir casting Process principle of Metal mould casting, Hot & Cold chamber castings, Continuous casting, Squeeze casting, Vacuum mould casting, Evaporative pattern casting, Ceramic shell casting, Vacuum Assisted Evaporative Pattern Casting Process(VAEPC).

14 Hours

UNIT 2

ADVANCED METAL FORMING PROCESSES: Introduction, Process principle and details of high energy rate forming (HERF) process, Electro-magnetic forming, explosive forming, Electro-hydraulic forming, Stretch forming, Contour roll forming.

6 Hours

UNIT 3

ADVANCED MACHINING PROCESSES I: Introduction, Process principle, Material removal mechanism, Parametric analysis and applications of processes such as; Ultrasonic machining (USM), Abrasive jet machining (AJM), Water jet machining (WJM), Abrasive water jet machining (AWJM), Electrochemical machining (ECM).

7Hours

UNIT 4

ADVANCED MACHINING PROCESSES II: Introduction, Process principle, Material removal mechanism, Parametric analysis and applications of processes such as; Electro discharge machining (EDM), Electron beam machining (EBM), Laser beam machining (LBM) processes.

7 Hours

UNIT 5

ADVANCED WELDING PROCESSES: Details of electron beam welding (EBW), laser beam welding (LBW), ultrasonic welding (USW), Plasma Arc Welding (PAW) and Plasma Arc cutting. Cladding and Heat treating.

6 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Advance Manufacturing Processes	Viney Kumar Singh.			
2	Manufacturing Technology Vol I and II	P N Rao	Mc Graw Hill Education India Private Limited	4th	ISBN 10: 1259062570 ISBN 13: 978-1259062575

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Materials and Manufacturing processes	Paul De Garmo.	Wiley	11th	ISBN 10: 0471656534 ISBN 13: 978-0471656531

Course Code: **TME 503**

Course Name: **DESIGN OF MACHINE ELEMENTS – I**

L T P C

3 1 0 4

UNIT 1

DESIGN FOR STATIC AND IMPACT STRENGTH: Design considerations: Codes and Standards. Static Strength: Static loads and Factor of Safety, Theories of failure. Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion Energy Theory; Failure of Brittle Materials, Failure of Ductile Materials. Stress Concentration, Determination of Stress Concentration Factor. Impact Strength: Introduction, Impact Stresses due to Axial, Bending and Torsional loads, Effect of Inertia.

9 Hours

UNIT 2

DESIGN FOR FATIGUE STRENGTH: Introduction- S-N Diagram, Low Cycle Fatigue, High Cycle Fatigue, Endurance Limit, Endurance Limit. Modifying Factors: Size effect, Surface effect, Stress Concentration effects. Fluctuating Stresses, Goodman and Soderberg relationship; Stresses due to Combined Loading, Cumulative Fatigue Damage.

9 Hours

UNIT 3

THREADED FASTENERS: Stresses in Threaded Fasteners, Effect of Initial Tension, Design of Threaded Fasteners under Static, Dynamic and Impact loads, Design of Eccentrically loaded Bolted Joints. **DESIGN OF SHAFTS:** Torsion of Shafts, Design for strength and Rigidity with Steady loading, ASME and BIS codes for Power Transmission shafting, Shafts under Fluctuating loads and combined loads.

9 Hours

UNIT 4

COTTER JOINT AND KNUCKLE JOINTS AND KEYS AND COUPLINGS: Design of Cotter and Knuckle Joints, Keys: Types of keys, Design of Keys and Design of Splines.

COUPLINGS: Rigid and Flexible Couplings: Flange Coupling, Bush and Pin type Coupling and Oldham's Coupling.

8 Hours

UNIT 5

RIVETED, WELDED JOINTS AND POWER SCREW: Types, Rivet Materials, Failures of Riveted Joints, Joint Efficiency, Riveted Brackets. Welded Joints – Types, Strength of Butt and Fillet welds, eccentrically loaded Welded Joints. **POWER SCREWS:** Mechanics of Power Screw, Stresses in Power Screws, Efficiency and Self-locking, Design of Power Screw, Design of Screw Jack (Complete Design).

7 Hours

DESIGN DATA HAND BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Design Data Hand Book	K. Lingaiah	McGraw Hill Professional	2nd	ISBN 10: 0071367071 ISBN 13: 978-071367073
2	Design Data Hand Book	K. Mahadevan and Balaveera Reddy	CBS Publication	4th	ISBN 10: 8123923155 ISBN 13:

					978-123923154
3	Machine Design Data Hand Book	H.G. Patil	Shri Shashi Prakashan, Belgaum	2nd	ISBN 10: 9380578962 ISBN 13: 978-380578965
4	PSG Design Data Handbook	PSG College of Technology, Coimbatore			ISBN 10: 8192735508 ISBN 13: 978-192735504

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Mechnanical Engeneering Design	Joseph E Shigley and Charles R. Mischke	McGraw Hill International	10th	ISBN 10: 0073398209 ISBN 13: 978-0073398204
2	Design of Machine Elements	V.B. Bhandari,	Tata McGraw Hill Publishing Company Ltd.	3rd	0070681791, 9780070681798

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Machine Design	Robert L. Norton	Pearson Education Asia	5th	ISBN 10: 013335671X ISBN 13: 978-0133356717
2	Design of Machine Elements	M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh,	Pearson Education	8th	
3	Machine Design	Hall, Holowenko, Laughlin (Schaum"s Outlines series) Adapted by S.K. Somani,	Tata McGraw Hill Publishing Company Ltd.,		007084352X, 9780070843523
4	Fundamentals of Machine Component Design,	Robert C. Juvinall and M Kurt Marshek,	Wiley India Pvt. Ltd.	3rd	ISBN 10: 1118012895 ISBN 13: 978-1118012895

Course Code: **TME-504**   L T P C
Course Name: **DYNAMICS OF MACHINES**   **3 1 0 4**

UNIT 1
STATIC FORCE ANALYSIS: Static Force Analysis: Introduction: Static Equilibrium. Equilibrium of Two and Three Force Members. Members with Two Forces and Torque, Free Body Diagrams, Principle of Virtual Work. Static Force Analysis of Four Bar Mechanism and Slider-Crank Mechanism with and without friction.

8 Hours

UNIT 2
DYNAMIC FORCE ANALYSIS: D‟Alembert‟s Principle, Inertia Force, Inertia Torque, Dynamic Force Analysis of Four-Bar Mechanism and Slider Crank Mechanism. Dynamically Equivalent Systems. Turning Moment Diagrams and Flywheels, Fluctuation of Energy. Determination of size of flywheels.

7 Hours

UNIT 3
FRICTION AND BELT DRIVES: Definitions, Types of Friction, Laws of friction, Friction in Pivotand Collar Bearings. Belt Drives: Flat Belt Drives, Ratio of Belt Tensions, Centrifugal Tension, Power Transmitted.
BALANCING OF ROTATING MASSES: Static and Dynamic Balancing, Balancing of Single Rotating Mass by Balancing Masses in Same plane and in Different planes. Balancing of Several Rotating Masses by Balancing Masses in Same plane and in Different planes.
BRAKES & DYNAMOMETERS
Shoe brake, Band brake, Band and Block brake, Absorption and transmission type dynamometers.

8 Hours

UNIT 4
BALANCING OF RECIPROCATING MASSES: Inertia Effect of Crank and Connecting rod, Single Cylinder Engine, Balancing in Multi Cylinder-inline engine (Primary and Secondary forces), V-type Engine; Radial Engine – Direct and Reverse Crank Method.
GOVERNORS: Types of Governors; Force Analysis of Porter and Hartnell Governors. Controlling Force, Stability, Sensitiveness, Isochronisms, Effort and Power.

9 Hours

UNIT 5
GYROSCOPE: Vectorial representation of Angular Motion, Gyroscopic Couple. Effect of Gyroscopic Couple on Ship, Plane Disc, Aero plane, Stability of Two Wheelers and Four Wheelers.

MECHANICAL VIBRATIONS: Types of vibrations, Degrees of freedom, Single degree free & damped vibrations, Forced vibration of single degree system under harmonic excitation, Critical speeds of shaft

12 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Theory of Machines	Sadhu Singh	Pearson Education	3rd	9332509786, 9789332509788
2	Theory of Machines.	S.S.Rattan	Tata McGraw Hill Publishing Company Ltd	4th	ISBN 10: 9351343472 ISBN 13: 978-9351343479
3	Theory of Machines	R.S Khurmi	S.Chand publication Company Ltd.	14th	812192524X, 9788121925242

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Theory of Machines	Thomas Bevan	CBS Publication	3rd	ISBN 10: 8123908741 ISBN 13: 978-8123908748
2	Design of Machinery	Robert L. Norton	McGraw Hill	3rd	ISBN 10: 0072864478 ISBN 13: 978-0072864472
3	Mechanism and Dynamics of machinery	J. Srinivas	Scitech Publications	2nd	

Course Code: **TME-505**   L T P C
Course Name: **FLUID MECHANICS**   **3 1 0 4**

UNIT 1
INTRODUCTION: Fluid and continuum, Physical properties of fluids, Rheology of fluids. Kinematics of Fluid flow: Types of fluid flows: Continuum and free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential, source, sink, doublet and half-body.

10 Hours

UNIT 2
FLUID STATICS: Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

DYNAMICS OF FLUID FLOW: Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, notches and weirs, momentum equation and its application to pipe bends.

10 Hours

UNIT 3
DIMENSIONAL ANALYSIS AND HYDRAULIC SIMILITUDE: Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance, geometric, kinematics and dynamic similarity, model studies.

4 Hours

UNIT 4
LAMINAR AND TURBULENT FLOW : Equation of motion for laminar flow through pipes, Stokes's law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and networks.

10 Hours

UNIT 5
BOUNDARY LAYER ANALYSIS : Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub layer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect.

9 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	First Course in Fluid Mechanics	S Narasimhan	University Press	1st	8173715645 978-8173715648
2	Introduction of fluid mechanics and Fluid Machines	Som, S.K. and Biswas G.	TMH	3rd	0071329196 978-0071329194
3	Fluid Mechanics and Turbomachines	M M Das	PHI Learning		978-81-203-3523-3

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Fluid Mechanics through Problems	R.J. Garde	New Age International Pvt. Ltd	3rd	8122430163, 9788122430165
2	Elementary Mechanics of Fluids	Hunter Rouse	John Wiley and Sons		047174316X, 9780471743163
3	Mechanics of Fluids	I.H.Shames	McGraw Hill	4th	0072472103, 9780072472103
4	Fluid Mechanics	Jagdish Lal	Metropolitan Book Company Pvt Ltd	9th	8120004221, 9788120004221
5	Fluid Mechanics and its Applications	Vijay Gupta and S.K.Gupta	Wiley Eastern Ltd	3rd	1906574928, 9781906574925
6	Hydrualics and Fluid Machines	P.N. Modi and S.H. Seth	Standard Book House	19th	8190089374 ISBN 13: 9788190089371

Course Code: **PME 511**   L   T   P   C
Course Name: **HEAT AND MASS TRANSFER LAB**   **0   0   3   2**

1. Determination of Thermal Conductivity of a Metal Rod.

2. Determination of Overall Heat Transfer Coefficient of a Composite wall.

3. Determination of Effectiveness on a Metallic fin.

4. To study the temperature distribution along the length of fin under free convection heat transfer.

5. . To study the temperature distribution along the length of fin under forced convection heat transfer.

6. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.

7. Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.

8. Determination of Emissivity of a Surface.

9. Determination of Stefan Boltzman Constant.

10. Determination of LMTD and Effectiveness in a Parallel Flow Heat Exchangers.

11. Determination of LMTD and Effectiveness in a Counter Flow Heat Exchangers.

12. Experiment on Boiling of Liquid.

13. Experiment on Condensation of Vapour.

14. Experiment on Transient Conduction Heat Transfer.

Course Code: **PME 512**   L T   P C
Course Name: **FLUID MECHANICS LAB**   **0 0   3 2**

1. To measure surface tension of a liquid.

2. Determination of coefficient of discharge of an orifice meter.

3. Determination of coefficient of discharge of V Notch (45° & 60°) and rectangular notch.

4. Determination of friction factor for the pipes.

5. Determination of coefficient of discharge of Venturimeter.

6. Determination of coefficient of discharge, contraction and velocity of an orifice.

7. To verify the Bernoulli's Theorem.

8. To find critical Reynolds number for a pipe flow.

9. Determination of the meta-centric height of a floating body.

10. Determination of the minor losses due to sudden enlargement, sudden contraction and bends.

11. To show the velocity and pressure variation with radius in a forced vertex flow.

12. To verify the momentum equation.

13. Determination of the coefficient of impact for vanes.

14. To study the boundary layer velocity profile and to determine the boundary layer thickness &displacement thickness.

Course Code: **PME-513**   L T P C
Course Name: **DYNAMICS OF MACHINES LAB**   **0 0 3 2**

1. To find stability and sensitivity of Watt Governor and prepare performance characteristics Curves

2. To find stability and sensitivity of Porter Governor and prepare performance characteristics Curves.

3. To find stability and sensitivity of Proell Governor and prepare performance characteristics Curves.

4. To find stability and sensitivity of Hartnell Governor and prepare performance characteristics Curves

5. To Determine gyroscopic couple on Motorized Gyroscope.

6. To perform Experiment on Static Balancing.

7. To perform Experiment on Dynamic Balancing.

8. To perform Experiment on CAM movement and profile plotting.

9. To perform Experiment on CAM movement and profile plotting for Tangent Follower.

10. To perform Experiment on CAM movement and profile plotting for Flat Faced Follower.

11. To perform Experiment on CAM movement and profile plotting for Mushroom Follower.

12. Determination of jump sped of cam-follower system.

13. To perform Experiment on critical speed of Whirling shafts.

14. To determine the Moment of Inertia of a Flywheel about its own axis of rotation.

Study Based Learning

1. Study of various mechanisms with the help of Models.

2. Study of various links with the help of Models.

Course Code: **TME-601**   L T P C
Course Name: **REFRIGERATION AND AIR CONDITIONING**   **3 1 0 4**

UNIT-1

REFRIGERATION: Introduction to refrigeration system, Methods of refrigeration(Ice refrigeration, air refrigeration, dry ice refrigeration, thermo electric refrigeration), Unit of refrigeration, Refrigeration effect & C.O.P.

AIR REFRIGERATION CYCLE: Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).   **8 Hours**

UNIT-2

VAPOUR COMPRESSION SYSTEM: Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid carbon dioxide, System practices for multistage system.
REFRIGERANTS: Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, substitutes of CFC Refrigerants.   **10 Hours**

UNIT-3

EQUIPMENT USED IN VAPOUR COMPRESSION REFRIGERATION SYSTEM: Compressors: Principle, types of compressors, capacity control. Condensers: Types and construction, Expansion devices: Types- Automatic expansion valve, Thermostatic expansion valves, capillary tube. Sizing Evaporator: Types and construction.

VAPOUR ABSORPTION SYSTEM: Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Temperature – concentration diagram & Enthalpy – concentration diagram of Ammonia – Water vapour absorption system, and Lithium- Bromide water vapour absorption system.   **10 Hours**

UNIT-4

AIR CONDITIONING: Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). Air Washers, Cooling towers & humidifying efficiency. Elementary knowledge of transmission and distribution of air through ducts and fans   **10 Hours**

UNIT-5

AIR CONDITIONING EQUIPMENT

Transmission and distribution of air: Room Air Distribution, Friction loss in ducts, dynamic losses in ducts, Air flow through simple Duct system, Duct design. Controls in Refrigeration and Air conditioning equipments: High pressure and low pressure cut out, thermostats, pilot operated solenoid valve, motor controls, bypass control-Damper motor. VAV controls.

AIR CONDITIONING AND REFRIGERATION APPLICATION

Food preservation, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Basic difference between comfort and industrial air conditioning.   **8 Hours**

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1	Refrigeration and Air-Conditioning	C. P. Arora	Tata McGraw Hill Publication	2nd	0074630105, 9780074630105
2	Refrigeration and Air-Conditioning	W. F. Stoecker, Jerold W. Jones	Tata McGraw Hill Publication	2nd	0070665915, 9780070665910
3	Refrigeration and Air-Conditioning	R. S. Khurmi, J. K. Gupta	S Chand & Company Limited	5th	8121927811, 9788121927819

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Principles of Regrigeration	R.J. Dossat	Pearson Education	5th	ISBN-10: 0130272701 ISBN- 13: 9780130272706
2.	Heating, Ventilation and Air Conditioning	Faye C.McQuiston Jerald D Parker Jeffrey D. Spitler	Wiley Students edition,2009	6th	ISBN-13: 978-0471470151 ISBN-10: 0471470155
3.	Air Conditioning Principles and Systems: An Energy Approach	Edward G. Pita P.E.	Prentice Hall	4th	ISBN-10: 0130928720 ISBN-13: 978-0130928726
4.	Refrigeration and Air-conditioning	Manohar Prasad	New Age International	3rd	8122436943 978-8122436945
5.	A Course in Refrigeration & Air-conditioning	S. C. Arora, S. Domkundwar	Dhanpat Rai		0000229660 9780000229663

Course Code: **TME 602**   L T P C
Course Name: **DESIGN OF MACHINE ELEMENTS-II**   **3 1 0 4**

UNIT 1
SPRINGS: types of springs- stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads.
LEAF SPRINGS: Stresses in leaf springs. Equalized stresses, Energy stored in springs, Torsion, Belleville and Rubber springs.   **8 Hours**

UNIT 2
SPUR GEARS: Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load.
HELICAL GEARS: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.
BEVEL GEARS: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.
WORM GEARS: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.   **10 Hours**

UNIT 3
CLASSIFICATION OF BEARINGS – Sliding contact & rolling contact. Design of sliding & journal bearing; method of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium. Selection of anti-friction bearings for different loads and load cycles. Mounting of the bearings. Method of lubrication, selection of oil sealshydrodynamic.   **8 Hours**

UNIT 4
CLUTCHES AND BRAKES: Design of Clutches: Single plate, multi plate and cone clutches. Design of
BRAKES: Block and Band brakes: Self locking of brakes: Heat generation in Brakes.
DESIGN OF LEVERS: application, design, hand lever, foot lever, cranked lever, lever safety valve,rocker arm for safety valve.   **9 Hours**

UNIT 5
IC ENGINE PARTS: Design of piston, connecting rod and crank shaft, cylinder.   **6 Hours**

TEXT BOOKS:

S. No	Title	Author	Publication	Edition	ISBN
1.	Mechanical Engineering Design	Joseph E Shigley and Charles R. Mischke	McGraw Hill	8th	0072832096, 9780072832099
2.	Design of Machine Elements	V. B Bhandari,	Tata McGraw Hill Publishing Company Ltd.,	2nd	0070681791 978-0070681798

REFERENCE BOOKS:

S. No	Title	Author	Publication	Edition	ISBN
1.	Machine Design	Robert L. Norton	Pearson	5th	013335671X 978-0133356717

Course Code: **TME 603**   L T P C
Course Name: **IC ENGINE**   **3 1 0 4**

UNIT 1
INTRODUCTION TO IC ENGINES: Definition, Heat cycles, Classification, Nomenclature and applications.
WORKING OF IC ENGINE: Four stroke petrol & diesel engines and their valve timing diagram, Two stroke petrol & diesel engines & their valve timing diagrams, comparison of two stroke & four stroke engines, Actual working of two and four stroke gas engine and their valve diagram.
                                                                                                                                      7 Hours

UNIT 2
FUEL AIR CYCLES AND THEIR ANALYSIS: Introduction to fuel air cycles and their significance, composition of cylinder gases, variable specific heats, Dissociation, effect of no. of moles, comparison of air standards & fuel air cycles, effect of operating variable like compression ratio, fuel air ratio, actual cycles and their analysis; Difference between Actual and Fuel-Air Cycles for S.I. and C.I. Engines.
                                                                                                                                      7 Hours

UNIT - 3
IC ENGINE FUELS: Introduction, types of fuels, solid, liquid and gaseous fuels, chemical structure of petroleum, petroleum refining process, important qualities of S.I. & C.I. Engine fuels and their rating. Combustion of fuels; Calorific values of fuels, determination of CV of fuel, combustion equation for hydrocarbon fuels, determination of minimum air requirement for combustion, Determination of % of carbon in fuel burning to CO & CO_2 , Determination of minimum quantity of air supplied to gaseous.
                                                                                                                                      7 Hours

UNIT - 4
FUEL SUPPLY SYSTEM: Supply Systems and pumps, properties of air fuel mixture, a simple carburetor working, Modern carburetors, introduction to petrol injection, fuel injection systems for C.I. Engines: classification of injection systems, injection pump, injection pump governor, mechanical governor, Fuel Injector, Nozzle, Injection of S.I. Engines,.
COMBUSTION IN S.I. ENGINES: Introduction, Stages of Combustion in S.I. Engine, Flame front propagation, factor influencing the flame speed, ignition lag and factors affecting the lag, Abnormal combustion and knocking, control and measurement of knock, rating of S.I. Engine fuels and anti knock agents, combustion chambers of S.I. Engines.
                                                                                                                                      8 Hours

UNIT - 5
SUPERCHARGING: Introduction, purpose of supercharging, type of superchargers, performance of superchargers, Turbo charged engines, supercharging of S.I. & C.I. Engines and Limitations.
MEASUREMENT AND TESTING: Measurement of friction horse power, brake horse power, indicated horse power, measurement of speed.
PERFORMANCE CHARACTERISTICS OF I.C. ENGINES: Performance parameters, performance of S.I. Engines, performance of C.I. Engine, Engine performance maps.
                                                                                                                                      13 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	IC Engines	R.K.Rajput	Laxmi Publication	2nd	8131800660
2.	IC Engines	M.L.Mathur R.P.Sharma	Dhanpat Rai Publication		8189928465 9788189928469

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	IC Engines	V.Ganeshan	Tata McGraw-Hill Education	2nd	0070494576, 9780070494572
2	A Course in Internal Combustion Engines,	Damkundwar	Dhanpath Rai and Sons	1st	8177000039 9788177000030
3.	Internal Combustion Engine Fundamentals	Johan B. Heywood	McGraw Hill Book Co., New York.	1st	978-0070286375 007028637X
4.	Introduction to Internal Combustion Engines	Richard Stone	MACMILAN, New York	4th	023057663X 9780230576636
5.	Engineering Fundamental of I.C Engine	Willard. Pulkrabek,	Prentice Hall International, Inc., New York	2nd	978-0131405707 0131405705

Course Code: **TME 604**   L T P C
Course Name: **FLUID MACHINERY**   **3 1 0 4**

UNIT 1
INTRODUCTION: Classification of Fluid Machines & Devices
IMPACT OF JET: Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat *&* *c*urve), Effect of inclination of jet with the surface. Force exerted by a jet on a series of curved vanes, Concept of velocity triangles, Equation for work done & efficiency.
HYDRAULIC TURBINES: Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel.
                                                                                                 14 Hours

UNIT 2
REACTION TURBINES: Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitation in turbines, Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.
                                                                                                 7Hours

UNIT 3
CENTRIFUGAL PUMPS: Classifications of centrifugal pumps, Vector diagram, Work done by impellor, efficiencies of centrifugal pumps, Minimum starting speed Specific speed of Pump,Model testing, Cavitation & separation and their control, Performance characteristics.
                                                                                                 6 Hours

UNIT 4
POSITIVE DISPLACEMENT PUMPS: Reciprocating pump theory, Slip and coefficient of discharges, Indicator diagram, Effect and acceleration, Work saved by fitting air vessels, Comparison of centrifugal and reciprocating pumps, Positive rotary pumps, Gear and Vane pumps, Performance characteristics.
                                                                                                 6 Hours

UNIT 5
OTHER MACHINES: Hydraulic accumulator, Special duty pumps, Intensifier, Hydraulic press, Lift and cranes, Theory of hydraulic coupling and torque converters, Performance characteristics.
WATER LIFTING DEVICES: Hydraulic ram, Jet pumps, Air lift pumps.
                                                                                                 6 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Hydraulic Machines,	Jagdish Lal	Metropolitan book co. pvt ltd	9th	8120004221 9788120004221
2.	Hydraulic Machines, Theory & Design	V.P.Vasandhani	Khanna Pub	11th	8174092501 9788174092502
3.	Fluid Mechanics & Machinery	R.K Bansal	Dhanpat Rai publication	9th	9788131808153
4.	Hydraulic Machines	R K Rajput	S.Chand & co Ltd	5th	9788121916684
5.	Hydraulic Machines	D S Kumar	S K KATARIA & SONS-NEW DELHI		9350140675 9789350140673

Course Code: **TOE 611 (OPEN ELECTIVE)**   L T P C
Course Name: **NANO TECHNOLOGY**   **3 0 0 3**

UNIT 1
INTRODUCTION TO PHYSICS OF SOLID STATE STRUCTURE: Size dependence of properties, crystal structures, face centered cubic Nano particles; Tetrahedral bounded semiconductor structures, lattice vibrations. Energy bounds: Insulators, semiconductor and conductors, RECIPROCAL SPACE; Energy bounds and gaps of semiconductors, effective masses, Fermi Surfaces. Localized Particles, Acceptors and deep taps, mobility, E actions.

8 Hours

UNIT 2
METHODS OF MEASURING PROPERTIES STRUCTURE: Atomic Structures; Crystallography; Particle size determination, surface structure.
MICROSCOPY: Transmission electron Microscopy; field ion microscopy Scanning Microscopy.
SPECTROSCOPY: Infrared and Raman Spectroscopy; Photoemission and X-ray Spectroscopy; Magnetic resonance, optical and vibration Spectroscopy, Luminescence.

8 Hours

UNIT 3
APPLICATIONS OF NANO MATERIALS: Medicine - Diagnostics, Drug delivery, Tissue engineering, Chemistry and environment - Catalysis, Filtration, Energy - Reduction of energy consumption , Increasing the efficiency of energy production , The use of more environmentally friendly energy systems, Recycling of batteries, Information and communication - Memory Storage, Novel semiconductor devices , Novel optoelectronic devices, Displays, Quantum computers, Heavy Industry - Aerospace, Construction, Vehicle manufacturers Consumer goods , Foods, Nano-foods, Household, Optics, Textiles, Cosmetics, Agriculture.

10 Hours

UNIT 4
CARBON NANO PARTICLES: Carbon Molecule: Nature of carbon bond; New carbon structures. Carbon Clusters: Small carbon clusters; Discovery of 60 c ; Strictures of 60 c , Alkali doped 60 c ; superconductivity in 60 c ; Large and smaller fullerenes; other bucky balls Carbon Nano tubes: Fabrication; structure, Electrical Properties; Vibrational properties, Mechanical Properties. Field emission and Shielding; Computers; Fuel cells, chemicals sensors; catalysis, Mechanical reinforcement.
BALLE NANOSTRUCTURE MATERIALS: Solid Disordered Nanostructure, Nano structured Crystals, Nano structured Ferromagnetism Basics of Ferromagnetism; Effect of structuring of Magnetic properties, Dynamics of Nano magnets; Nano pore containment of magnetic particles, Nano carbon Ferro magnets, Giant and colossal magneto resistance; Ferro fluids.

8 Hours

UNIT 5
QUANTUM WELLS: Wires and Dots, Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared detectors; Quantum dot laser Superconductivity. Nano-machines and Nano-device, Micro electromechanical systems (MEMS) Nano electromechanical systems (NEMS), Fabrication, Nano devices and Nano machines. Molecular and Super molecular switches Applications areas of Nanotechnology in Engineering.

8 Hours

TEXTBOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Introduction to Nanotechnology	C.P.Poole Jr F.J. Owens	Wiley	1st	9812532331 9789812532336

Course Code: **TOE 612 (OPEN ELECTIVE)**   L T P C
Course Name: **ENTREPRENEURSHIP DEVELOPMENTPROGRAMME**   **3 0 0 3**

UNIT 1
ENTREPRENEUR: Definition. Growth of small scale industries in developing countries and their positions vis a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control type. Government policy for small scale industry; stages in starting a small scale industry.

9 Hour

UNIT 2
PROJECT IDENTIFICATION: Assessment of viability, formulation, Evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods. **Accountancy-** Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control.

10 Hour

UNIT 3
QUALITY CONTROL AND MARKETING: Industrial relations.sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

7 Hours

UNIT 4
PROJECT PLANNING AND CONTROL: The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow.

7 Hours

UNIT 5
CAPITAL EXPENDITURE AND OPERATIONS: Control of financial flows, control and communication. Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.

9 Hours

TEXT BOOK:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Essential of Management	Joseph, L. Massod	Prentice Hall of India	4th	0132863375 9780132863377

.

Course Code: **TOE 613 (OPEN ELECTIVE)**   L   T   P   C
Course Name: **QUALITY SYSTEM and MANAGEMENT**   **3   0   0   3**

UNIT 1
INTRODUCTION: Definition, need of quality systems, role of quality standards, stages of quality assurance systems. quality charts, control charts for variables and attributes, acceptance sampling.

9 Hour

UNIT 2
QUALITY SYSTEMS: Overall responsibility for progress of quality systems. quality manuals, procedures and role of auditing, auditing for conformance versus quality for effectiveness, auditing a tool for quality improvement.

10 Hour

UNIT 3
QUALITY SYSTEMS: ISO 9000 quality systems, British Standards BS5750/ISO 9000 origin of standards, requirements, issues associated with implementation.

8 Hour

UNIT 4
QUALITY CIRCLES AND CHARTS : Quality circles and different charts which are to be maintain to ensure quality. Raw material inspection systems.

9 Hour

UNIT 5
REGISTRATION AND ACCREDITATION IN QUALITY SYSTEM: Certification, approval, registration of leading accessory. Quality circles and inspection.

9 Hour

TEXT BOOK:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Total Quality Management for Engineers	Mohamod zairi	Woodhead Publishing	1st	9781855730243 9781845698911

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Quality Planning and Analysis	J.M. Juran Frank M. Gryna	Mc-Graw Hill.		0070331839 978-0070331839
2.	Total Quality: Management, Organization, and Strategy	James R. Evans,and J.W. Dean	West Publishing Company,		0314028269, 9780314028266

Course Code: **TOE-614 (OPEN ELECTIVE)**   L T P C

Course Name: **SOLAR ENERGY**   **3 0 0 3**

UNIT 1
INTRODUCTION: Energy alternative, Devices for thermal collection and storage, Thermal applications.
Solar radiation: Instruments for measuring solar radiation, Solar radiation geometry, Empirical equations for prediction the availability of solar radiation, Solar radiation on tilted surfaces.

8 Hours

UNIT 2
LIQUID FLAT- PLATE COLLECTORS: General performance analysis, Transmissivity absorptivity product and overall loss coefficient and heat transfer correlations, Collector efficiency factor, Numerical, Analysis of collectors similar to the conventional collector. Testing procedures, Alternatives to the conventional collector, Numerical.

7 Hours

UNIT 3
SOLAR AIR HEATERS: Performance analysis of a conventional air heater, Other types of air heaters.
Concentrating collectors: Flat plate collectors with plane reflectors, cylindrical parabolic collector, Compound parabolic dish collector, Central receiver collector, Numerical.

7 Hours

UNIT 4
THERMAL ENERGY STORAGE: Sensible heat storage, Latent heat Storage, Thermo chemical storage .
Solar distillation: Introduction, working principal of solar distillation, Thermal efficiency of distiller unit.

6 Hours

UNIT 5
EXTERNAL HEAT TRANSFER: Top loss coefficient, Bottom and side loss coefficient, Internal heat transfer, Radioactive loss coefficient, connective loss coefficient, Evaporative loss coefficient, Overall heat Evaluation of distillation output, Passive solar stills, Conventional solar still, Basin construction, Thermal analysis of conventional solar still.
Photovoltaic systems: Introduction doping Fermi level, P-N junction characteristics, Photovoltaic effect, Photovoltaic material, Module, Cell temperature, Numerical. Economic analysis: Introduction, cost analysis.

14 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Solar Energy	S.P Sukhatme: J Nayak	Tata McGraw Hill.	3rd	0070260648 9780070260641
2.	Treatise on Solar Energy	H.P Garg	John Wiley and Sons.		

REFERENCE BOOKS:

S.No	Title	Author	Publication	Edition	ISBN
1.	Solar Energy: Thermal Processes	Duffie John A, and Beckman W.A	John Wiley and Sons	4th	0470873663 9780470873663

Course Code: **TOE 615 (OPEN ELECTIVE)**   L T P C
Course Name: **ADVANCED WELDING TECHNOLOGY**   **3 0 0 3**

UNIT 1
INTRODUCTION: Importance and application of welding, classification of welding process. Selection of welding process.
BRIEF REVIEW OF CONVENTIONAL WELDING PROCESS: Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS.CI, Al, Stainless steel & Maurer/Schaefflar Diagram. Soldering & Brazing.

9 Hours

UNIT 2
ADVANCED WELDING TECHNIQUES: Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

8 Hours

UNIT 3
ADVANCED WELDING TECHNIQUES (CONTINUED): Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spray-welding/ Metalizing, Hard facing.

8 Hours

UNIT 4
WELD DESIGN: Welding machines/equipments and its characteristics and arc-stability, Weld defects and distortion and its remedies, Inspection/testing of welds, Weld Design, Welding of pipe-lines and pressure vessels. Life predication.

8 Hours

UNIT 5
THERMAL AND METALLURGICAL CONSIDERATION: Thermal considerations for welding, temperature distribution, Analytical/Empirical analysis/formulae, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties.

9 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Welding and Welding Technology	Richard L. Little	McGraw-Hill Inc.,US		0070380953 978-0070380950

Course Code: **TOE 616 (OPEN ELECTIVE)**　　　　　　　　　　　L　T　P　C

Course Name: **STATISTICAL QUALITY CONTROL**　　　　　　**3　0　0　3**

UNIT 1

INTRODUCTION: Concept and evoluation of quality control Measurement & Metrology, Precision vs accuracy. Process capability, standrdisation & Interchangeability.

INSPECTION AND GAUGES: Inspection methods. Types of Gauges. Limits Fits and Tolerances. Non Destructive Testings & Evaluation.

8 Hours

UNIT 2

CONTROL CHARTS FOR SQC: Statistical Quality Control (SQC). Control charts for variables such as X, R charts and control charts for attributes such as p-charts, c-chart. Construction & use of the control charts. Process capability.

8 Hours

UNIT 3

ACCEPTANCE SAMPLING FOR SQC: Principle of acceptance sampling. Producer's and consumer's risk. Sampling plans - Single, double & sequential. Sampling by attributes and variables.

8 Hours

UNIT 4

RELIABILITY: Introduction to reliability, bath-tub curve. Life expectancy. Reliability based design. Series & Parallel system.

DEFECT DIAGNOSIS AND PREVENTION: Basic causes of failure, curve/control of failure. MTBF. Maintainability, An Introduction to Condition monitoring and diagnostic techniques. Value Engineering: An introduction and its functions.

8 Hours

UNIT 5

TQM: Inspection, Quality control, Quality Assurance and Quality Management and Total Quality Management. Implementation of TQM. ISO 9000 and its series, Zero defect. Quality circle. Taguchi Method.

OTHER FACTORS IN QUALITY: Human Factors such as attitude and errors. Material-Quality. Machine Capability and Manufacturing process limitations. Quality in sales & service. Methods for improving accuracy & quality.

8 Hours

TEXT BOOKS :

S.No.	Title	Author	Publication	Edition	ISBN
1.	Statistical Quality Control	Grant and Leavarworth	McGraw HIll	7th	0070435553 9780070435551
2.	Maintenance for Reliability	P.N Rao			
3.	Statistical Quality Control	S.S.Mahajan	Dhanpat rai publication	1st	8177000659 9788177000658

Course Code: **PME-611**   L   T   P   C
Course Name: **REFRIGERATION AND AIRCONDITIONING LAB**   **0   0   3   2**

1. Determination of COP of a Domestic Refrigeration, using vapour compression test rig

2. Determination of refrigeration effect of Domestic Refrigerator.

3. Study of mechanical heat pump. Calculate the COP of mechanical heat pump.

4. Calculate the relative humidity of a Desert Cooler, using desert Cooler test rig.

5. Calculate the volumetric efficiency of reciprocating Air compressor.

6. Study of vapour compression air conditioning unit and Calculate Refrigeration effect of air conditioning unit using air conditioning test rig.

7. Calculate COP of air conditioning unit.

8. Calculate the COP of eletrolux vapour absorption system using electrolux test rig.

9. Calculate the refrigeration effect of eletrolux vapour absorption system using electrolux test rig.

10. Calculate the COP of Ice plant test rig.

11. Calculate the refrigeration effect of Ice plant test rig.

12. Calculate the capacity of cooling tower equipment with pump and fun.

13. Calculate the volumetric efficiency of a Air blower.

14. Calculation/ Estimation of cooling load for large building.

15. To study the process of humidification, pre-heating, cooling and de-humidification, and re-heating. and ploting of a psychrometric chart for moist air.

Course Code: **PME-612**   L   T   P   C
Course Name: **DESIGN LAB**   **0   0   3   2**

Note: Students are required to perform minimum 8 experiments out of these 12 experiments.

      1. i.   MATLAB programming on Vectors

        ii.   MATLABprogramming on Matrices

      2. i.   Working on Graphics Window

        ii.   Working with Functions

      3. i.   Numerical on for loop

        ii.   Numerical on while loop

      4. i.   MATLABprogramming of if else statement

        ii.   Working with Script files

      5. i.   Working on root finding techniques

        ii.   Working on Optimization techniques

      6. i.   Solving system of Linear Equations

        ii.   Gauss Jordon Elimination

      7. i.   Solving for roots of non-linear equations

        ii.   Computing forces on truss

      8. i.   Computing reaction internal force

        ii.   Programming of bending moment problems

      9. i.   Solving for Ordinary differential equations

        ii.   Programming of Euler method

    10. i.   Programming of RungeKutta method

        ii.   Numerical Differentiation and Integration

    11. i.   Programming code of Trapezoidal rule

        ii.   Programming code of Simpsons rule

    12. i.   Solving for the Friction coefficient and head loss through pipes

        ii.   Introduction to SIMULINK

    13. i.   Model a bouncing ball using SIMULINK

        ii.   Analysis of a ball bouncing on an oscillating surface

    14. i.   Modeling a damped mass system using SIMULINK

        ii.   Working with tool boxes

Course Code: **PME-613**   L   T   P   C
Course Name: **FLUID MACHINERY   LAB**   **0   0   3   2**

1. To determine the power of a Pelton wheel for various head and to plot curves Q, P Vs N at full gate opening.

2. To determine the power of a Pelton wheel for various head and to plot curves Q, P Vs N at three-fourth gate opening.

3. To determine the power of a Francis turbine for various head and to plot curves Q, P Vs N at full gate opening.

4. To determine the power of a Francis turbine for various head and to plot curves Q, P Vs N at three-fourth gate opening.

5. To determine the power of a Kaplan turbine for various head and to plot curves Q, P Vs N at full gate opening.

6. To determine the power of a Kaplan francis turbine for various head and to plot curves Q, P Vs N at three-   fourth gate opening.

7. To analysis the efficiency of a Centrifugal Pump at various load and to plot curves h, Power Vs Q.

8. To analysis the efficiency of a Hydraulic Ram and its Rankine, efficiency (h).

9. To determine the efficiency of a Reciprocating pump and to plot the P and hVs H.

10. To analysis the power of a Gear Pump and to plot the curves Q.P Vs Pressure rise.

11. .To analyze the constructional details of a Hydraulic Ram and determine its various efficiencies.

12. To analysis the layout of a Hydro power plant.

13. To analysis of impact of jet for flat and hemispherical vanes.

14. To analysis of a reciprocating compressor and compare it with centrifugal compressor

Course Code: **TME 701**   L T P C

Course Name: **INDUSTRIAL AUTOMATION**   **3 0 0 3**

UNIT 1
INTRODUCTION: Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies
MANUFACTURING OPERATIONS: Manufacturing Operations, Product/Production Relationship, Production concepts and Mathematical Models & Costs of Manufacturing Operations.
8 Hours

UNIT 2
INDUSTRIAL CONTROL SYSTEM: Basic Elements of an Automated System, Advanced Automation Functions & Levels of Automation, Continuous versus Discrete control, Computer Process control, Forms of Computer Process Control.
AUTOMATED MANUFACTURING SYSTEMS: Components of a Manufacturing systems, Classification of Manufacturing Systems, overview of Classification Scheme, Single Station Manned Workstations and Single Station Automated Cells.
9 Hours

UNIT 3
GROUP TECHNOLOGY & FLEXIBLE MANUFACTURING SYSTEMS: Part Families, Parts Classification and coding, Production Flow Analysis, Cellular Manufacturing, Flexible Manufacturing Systems: What is an FMS, FMS Components, FMS Applications & Benefits, and FMS Planning & Implementation Issues.
QUALITY CONTROL SYSTEMS: Traditional and Modern Quality Control Methods, Taguchi Methods in Quality Engineering. Introduction to SQC Tools.
9 Hours

UNIT 4
INSPECTION TECHNOLOGIES: Automated Inspection, Coordinate Measuring Machines Construction, operation & Programming, Software, Application & Benefits, Flexible Inspection System, Inspection Probes on Machine Tools, Machine Vision, Optical Inspection Techniques & Noncontact Nonoptical Inspection Technologies.
8 Hours

UNIT 5
MANUFACTURING SUPPORT SYSTEM: Process Planning, Computer Aided Process Planning, Concurrent Engineering & Design for Manufacturing, Advanced Manufacturing Planning, Just-in Time Production System, Basic concepts of lean and Agile manufacturing. Basic Concepts of Lean and Agile manufacturing, Comparisons of Lean & Agile Manufacturing.
8 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Automation, Production Systems and Computer Integrated Manufacturing	M. P. Groover	Pearson	3rd	8120334183 9788120334182
2.	Principles of CIM	S. Kant Vajpayee	PHI		0024222410 978-0024222411

REFERENCE BOOKS:

S.No	Title	Author	Publication	Edition	ISBN
1.	Performance Modelling of Automated Manufacturing Systems	N Viswanadham , Y Narahari	PHI Publication	1st	8120308700 9788120308701
2.	Computer Based Industrial Control	Krishna Kant,	PHI Publication	2nd	8120339886 9788120339880
3.	Anatomy of Automation	Amber G.H & P. S. Amber	Prentice Hall		0130353035 978-0130353030

Course Code: **TME 702** L T P C
Course Name: **COMPUTER AIDED DESIGN & MANUFACTURING(CAD/CAM)** **3 0 0 3**

UNIT 1
FUNDAMENTALS OF CAD: Introduction, Design Process: Application of computers in Design: Creating manufacturing database: benefits of CAD. Computer Hardware; Graphic input devices; display devices; Graphics output devices; Central processing unit (CPU).
CAD SOFTWARE AND DATABASE: Software configuration of a graphics system: functions of a graphics package: geometric modelling: Database structure and control; Graphics standard: GKS and IGES. Geometric Transformations: Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation: Concatenation of transformation matrices.

8 Hours

UNIT 2
REPRESENTATION OF CURVES AND SURFACES: Polygon, meshed and ruled surfaces:Bezier curves; B-spline curves. Geometric Modelling: Wireframe model: solid modeling: representation, volumetric properties, surface modelling.

8 Hours

UNIT 3
GROUP TECHNOLOGY (GT): Part families; part classification ,Group technology machine cells: Advantages of GT. Computer Aided Process Planning: Introduction and benefits of CAPP. Types of CAPP system, Flexible Manufacturing System (FMS) its advantages, components of a FMS system.

8 Hours

UNIT 4
INTRODUCTION TO AUTOMATION AND NEED AND FUTURE OF NC SYSTEMS AND CAM: Advantages &disadvantages. Classification. Open and closed loop systems. Historical development and future trends. Difference between ordinary and NC machine tools. Methods for improving Accuracy and Productivity.

8 Hours

UNIT 5
NC PART PROGRAMMING- (a) Manual (word address format) programming. Examples Drilling Robotics- NC machine vs Robots. Types and generations of Robots. Robot applications. Economics, Introduction to Artificial Intelligence for Intelligent manufacturing.

8 Hours

TEXT BOOKS :

S.No.	Title	Author	Publication	Edition	ISBN
1.	Computer control of manufacturing systems	Yoram Koren	McGraw-Hill	1st	0070607435 978-0070607439
2.	Robotics for engineers	Yoram Koren	McGraw-Hill, 1985		0070353999, 9780070353992
3.	Numerical control of machine tools	Yoram Koren, Joseph Ben-Uri	Khanna Publisher		EBK0019858
4.	CAD/CAM : Computer-Aided Design and Manufacturing	M. Groover, E. Zimmers	Pearson India	1st	8177584162 9788177584165
5.	Numerical Control of Machine Tools	S. Martin	Butterworth-Heinemann Ltd		ISBN-10: 0340124156 ISBN-13: 978-0340124154
6.	CAD/CAM: Principles and Applications	P.N.RAO	Tata McGraw-Hill Education	2nd	0070583730, 9780070583733

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	The Finite Element Method	O.C. Zienkiewicz and R.L. Taylor	McGraw Hill	4th	0070841748 978-0070841741
2.	An Introduction to Finite Element Method	J. N. Reddy	McGraw Hill	2nd	0071127992 978-0071127998
3.	Finite Element Procedure in Engineering Analysis	K.J. Bathe	McGraw Hill	3rd	0133173054 978-0133173055

Course Code: **TME 703**   L   T   P   C
Course Name: **PRODUCT DESIGN AND DEVELOPMENT**   **3   0   0   3**

1. INTRODUCTION TO PRODUCT DESIGN: ASIMOW,S MODEL

Definition of product design, Design by evolution, Design by innovation, Essential factors of product design, The morphology of design (the seven phases), Phase I – feasibility study, Phase II – preliminary design, Phase III-detailed design, Phase IV-planning the production process, Phase V- planning for distribution, Phase VI - planning for consumption, Phase VII - planning for retirement, , Role of allowance processes capability and tolerance in detailed design and assembly, Allowance (a), Process capability (p), Tolerance (t), Types of fits, Selection of fits, Specific principles,

2. PRODUCT DESIGN PRACTICE AND INDUSTRY

Introduction, Product strategies, Analysis of product, Product and market, The product characteristics, The three S's, Standardization, The designer : myth and reality, The industrial design, organization, Basic design considerations, Role of aesthetics in product design, Functional design practice.

3. VALUE ENGINEERING AND PRODUCT DEVELOPMENT

What is value? Nature and measurement of value, importance of value, and the value analysis job plan.
What is a product, defining a product by nature of demand, new product strategy, product classification Product development and product management: The product life cycle. New product development and its process.

4. ROLE OF COMPUTER IN PRODUCT DESIGN , MANUFACTURING AND MANAGEMENT

CAD/CAM :Some definitions, product cycle and CAD/CAM, role of computer in manufacturing. Role of computer in design process. Computer integrated manufacturing (CIM). Group technology and its benefits. Computer aided process planning (CAPP). Production flow analysis. Types of CAPP. MRP, FMS, JIT.

5. QUALITY ASSURANCE IN PRODUCT DESIGN AND MANUFACTURING

Theory of sampling inspection: Single sampling plans, the operating characteristic curves, Basic definitions of: the AQL (Acceptable quality level) and LTPD (Lot tolerance proportion defective), the AOQ curve and the AOQL, average total inspection (ATI). Sampling plan for attributes and variables. Control charts: $\bar{X}$ and R charts. Basics concepts of: p charts, np charts, u charts, six sigma, relationship between c_p and C_{pk} values.

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Product Design and Manufacturing	A.K. Chitale and R.C. Gupta	Prentice- Hall India	5th	9788120342828 8120342828
2.	Product Design: Techniques in Reverse Engineering and New Product Development	Kevin Otto and Kristin Wood	Pearson Education	1st	9788177588217 8177588214

REFERNCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Engineering Design	Dieter George	Tata McGraw Hill	5th	0073398144 978-0073398143
2.	Product Lifecycle Management	Micheal Grieves	Tata McGraw Hill	3rd	9780071452304 0071452303
3.	Handbook of Product Designfor Manufacturing	James G Bralla	Tata McGraw Hill	2nd	0852969767 9780070071391

Course Code: **TME 704**   L   T   P   C
Course Name: **OPERATIONS RESEARCH & OPTIMIZATION TECHNIQUES**   **3   0   0   3**

UNIT 1
INTRODUCTION: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.
SOLUTION OF LINEAR PROGRAMMING PROBLEMS: The simplex method-canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

8 Hours

UNIT 2
TRANSPORTATION PROBLEM: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Assignment Problem-formulation, types, application to maximization cases and travelling salesman problem.

8 Hours

UNIT 3
INTEGER PROGRAMMING: Pure and mixed integer programming problems, solution of Integer programming problems-Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-One programming.
PERT-CPM TECHNIQUES: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

10 Hours

UNIT 4
QUEUING THEORY: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models and their steady state performance analysis.
GAME THEORY: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

9 Hours

UNIT 5
SEQUENCING: Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing 2 jobs on 'm' machines using graphical method.

6 Hours

TEXT BOOKS

S.No.	Title	Author	Publication	Edition	ISBN
1.	Operations Research	P K Gupta and D S Hira	S.Chand Publications, New Delhi - 2007		ISBN-10: 8121902819 ISBN-13: 978-8121902816
2.	Operations Research	H. A.TAHA	Prentice Hall	9th	978-0132555937 013255593X

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Operations Research	A P Verma	S K Kataria &Sons, 2008	9th	ISBN-13: 978-0132555937 ISBN-10: 013255593X
2.	Operations Research	R. Panneerselvam	PHI	2nd	8120329287, 9788120329287
3.	Operations Research	A M Natarajan, P Balasubramani	Pearson Education, 2005		8131700003, 9788131700006
4.	Introduction to Operations Research	Hiller and Liberman	McGraw Hill	7th	0072416181 9780072416183
5.	Operations Research	S.D. Sharma	Ledarnath Ramanath & Co, 2002	4th	0230638856, 9780230638853.

Course Code: **TME 711 (ELECTIVE –I)**   L T P C
Course Name: **OPTIMIZATION TECHNIQUES IN ENGINEERING**   **3 0 0 3**

UNIT 1
UNCONSTRAINED OPTIMIZATION: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.
                                                                                      5 Hours

UNIT 2
CONSTRAINED OPTIMIZATION: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn Tucker Sufficient Conditions.
                                                                                      9 Hours

UNIT 3
OPTIMIZATION: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg- Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Liner Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches – Blue.
                                                                                      10 Hours

UNIT 4
OPTIMIZATION AND FUNCTIONS OF A COMPLEX VARIABLE AND NUMERICAL ANALYSIS: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Method and the Runga-Kutta Method for Ordinary Differential Equations, Gaussian Quardative Tranzoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions, Jacobi's Iteration Method.
                                                                                      9 Hours

UNIT 5
OPTIMIZATION IN OPERATION RESEARCH: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Trans shipment Problems, Heuristic Methods.
                                                                                      9 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Operations Research: Applications and Algorithms	Winston W L:	Cengage Learning India Pvt Ltd	4th	0534423620 9780534423629
2.	Optimization: Theory and Applications.	S.S Rao	Mehul Excluisve	4th	8126540443 9788126540440
3.	Methods of Optimization.	Walsh G R	John Wiley & Sons; revised reprint edition (1979)		0783732155, 9780783732152

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Model Building in Mathematics Programming	H.P. Williams, Paul Williams	John Wiley & Sons Inc	4th	0471997889 9780471997887
2.	Discrete Optimization	R.G. Parker and R.L. Rarding	Academic Press		0125450753 978-0125450751

Course Code: **TME 712 (ELECTIVE –I)**   L T P C
Course Name: **RELIABILITY ENGINEERING**   **3 0 0 3**

UNIT 1
INTRODUCTION: Definition of reliability, types of failures, definition and factors influencing system effectiveness, various parameters of system effectiveness.
8 Hours

UNIT 2.
RELIABILITY MATHEMATICS: Definition of probability, laws of probability, conditional probability, Bay's theorem; various distributions; data collection, recovery of data, data analysis Procedures, empirical reliability calculations.
9 Hours

UNIT 3
RELIABILITY: Types of system- series, parallel, series parallel, stand by and complex; development of logic diagram, methods of reliability evaluation; cut set and tieset methods, matrix methods event trees and fault trees methods, reliability evaluation using probability distributions, Markov method, frequency and duration method.
9 Hours

UNIT 4
RELIABILITY IMPROVEMENTS: Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance. **8 Hours**

UNIT 5
RELIABILITY TESTING: Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards. **8 Hours**

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Reliability Evaluation of Engineering and Systems	R.Billintan & R.N. Allan	Plenum Press.	2nd	1489918620 9781489918628
2.	Reliability in Engineering and Design	K.C. Kapoor & L.R. Lamberson	John Wiely and Sons	1st	0471511919 9780471511915

REFERNCE BOOKS :

S. No	Title	Author	Publication	Edition	ISBN
1.	Life Testing and Reliability Estimation	S.K. Sinha & B.K. Kale	Wiely Eastern Ltd.		0852268203 978-0852268209
2.	Probabilistic Reliability, An Engineering Approach	M.L. Shooman	McGraw Hill.	2nd	978-0898748833 0898748836
3.	System Reliability Engineering	G.H.Sandler	Prentice Hall.		

Course Code: **TME 713 (ELECTIVE –I)**   L T P C
Course Name: **NON-CONVENTIONAL ENERGY RESOURCES & UTILIZATION**   **3 0 0 3**
UNIT 1
ENERGY RESOURCES AND THEIR UTILIZATION : Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems.
SOLAR RADIATIONS: Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Solar radation data for India.

7 Hours

UNIT 2
SOLAR ENERGY: Solar thermal power and it's conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing . Solar thermal energy storage, Different systems, Solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants.
SOLAR PHOTOVOLTAIC SYSTEM: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system.

7 Hours

UNIT 3
BIO GAS: Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India.
WIND ENERGY: Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Selection of a wind mill, Wind energy farms, Economic issues, Recent development.

9 Hours

UNIT 4
ELECTROCHEMICAL EFFECTS AND FUEL CELLS: Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells .
TIDAL POWER: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems.
HYDROGEN ENERGY: Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.

10 Hours

UNIT 5
THERMOELECTRIC SYSTEMS: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators.
GEOTHERMAL ENERGY: Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion.

OCEAN ENERGY; Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

9 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Renewable energy sources and conversion technology	Bansal Keemann, Meliss	Tata McGraw Hill.		0074600230 978-0074600238
2.	Renewable energy resources and emerging technologies	D.P. Kothari	Prentice Hall of India Pvt. Ltd.		8120333578, 9788120333574

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Non-Conventional energy Sources	Rai G.D	Khanna Publishers.		8174090738 978-8174090737
2.	Nonconventional Energy	Ashok V. Desai	New Age International Publishers Ltd.		9788122402070

Course Code: **PME-711**   L   T   P   C
Course Name: **AUTOMATION & FMS LAB**   **0   0   3   2**

1. Analysis of various aspects of CNC machine

2. Analysis of preparatory and miscellaneous functions of CNC

3. Simulation of Facing operation carried out on simulation packages like Master cam

4. Simulation of Turning operation

5. Simulation of Taper Turning operation

6. Simulation of Step Turning operation

7. Simulate manual part programming of Milling Profile operation on CNC

8. Simulate manual part program of Milling Corner radius operation

9. Simulation of Chamfering and Corner radius operation on CNC machine

10. Simulation of Drilling operation on CNC turning machine

11. Analysis of Flexible Manufacturing System

12. Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor

13. Interfacing of CNC lathe, milling with loading &unloading arm and ASRS to be carried out on simple components

14. Robot programming: Offline programming to perform pick and place and stacking of objects.

Course Code: **PME 712**   L T P C
Course Name: **PROJECT PHASE I**   **0 0 3 2**

STUDENTS ARE ADVISED TO INITIATE THE PROJECT WORK, ON ANY TOPIC RELATED TO MECHANICAL ENGINEERING OR RELAVENT FIELD. TOPICS CAN BE DISCUSSED WITH THE GUIDES AND IN LAST MONTH OF THE SEMESTER, THEY ARE REQUIRED TO SUBMIT A SYNOPSIS TO THE RESPECTIVE GUIDES, WITH A POWER POINT PRESENTATION OF THEIR WORK PLAN.

Course Code: **PME 713**   L T P C
Course Name: **SEMINAR ON INDUSTRIAL TRAINING**   **0 0 3 2**

STUDENTS ARE REQUIRED TO SUBMIT A POWER POINT PRESENTATION ON THEIR INDUSTRIAL TRAINING, MENTIONING THE MACHINES USED, TECHNOLOGY LEARNT & PROCESS ADOPTED BY THE CONCERNED INDUSTRY FOR A PARTICULAR PRODUCT MANUFACTURING.

Course Code: **TME 801**   L T P C
Course Name: **AUTOMOBILE ENGINEERING**   **3 0 0 3**

UNIT 1
ENGINE COMPONENTS AND COOLING & LUBRICATION SYSTEMS: Spark Ignition
(SI) & Compression Ignition (CI) engines, cylinder - arrangements and their relatives merits,
Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port
timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, Compression
ratio, methods of a Swirl generation, choice of materials for different engine components, engine
positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication
arrangements.

6 Hours

UNIT 2
FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels,
alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements
for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection
systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors.
SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction,
Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.
IGNITION SYSTEMS: Battery Ignition systems, magneto Ignition system, Transistor assist contacts.
Electronic Ignition, Automatic Ignition advance systems.
FUEL SUPPLY SYSTEM: Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel
Pump, Carburettor etc. MPFI.

10 Hours

UNIT 3
POWER TRAINS: General arrangement of clutch, Principle of friction clutches, Torque
transmitted, Constructional details, Fluid flywheel, Single plate, multi-plate and centrifugal clutches.
Gear box: Necessity for gear ratios in transmission, synchromesh gear boxes, 3, 4 and 5 speed gear boxes.
Freewheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters,
Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations
for torque transmission by clutches.

10 Hours

UNIT 4
DRIVE TO WHEELS: Propeller shaft and universal joints, Hotchkiss and torque tube drives, differential,
rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin
inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power
steering, general arrangements of links and stub axle, over steer, under steer and neutral steer, numerical
problems, types of chassis frames.
SUSPENSION, SPRINGS AND BRAKES: Requirements, Torsion bar suspension systems, leaf spring,
coil spring, independent suspension for front wheel and rear wheel. Air suspension system. Types of
brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and
working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock -
Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel
antilock & Numerical Problems

11 Hours

UNIT - 5
AUTOMOTIVE EMISSION CONTROL SYSTEMS: Automotive emission controls, Controlling
crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel
mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-
injection system, Air-aspirator system, Catalytic converter, Emission standards- Euro I, II, III and IV
norms, Bharat Stage II, III norms.

5 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Automotive Mechanics	Joseph Hietner	CBS Publisher	2nd	8123908911 9788123908915
2.	Automobile Engineering	Kripal Singh	Standard		8180141241 9788180141249

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	The Motor Vehicle	Newton and Steeds.	Society of Automotive Engineers,		1560918985, 9781560918981

Course Code: **TME 802**   **L T P C**
Course Name: **POWER PLANT ENGINEERING**   **3 0 0 3**

UNIT 1

INTRODUCTION: Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, calculations. Variable Load problem Industrial production and power generation compared, ideal and realized load curves, terms and factors. Effect of variable load on power plant operation, methods of meeting the variable load problem. Power plant economics and selection Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.

9 Hours

UNIT 2

STEAM POWER PLANT: Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories. General layout of steam power plant. Different systems such as fuel handling system, pulverizes and coal burners, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing, feed heating, boiler-heating , flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency.

9 Hours

UNIT-3

DIESEL POWER PLANT: General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance. Gas turbine power plant: Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, combined cycle power plants.

8 Hours

UNIT-4

NUCLEAR POWER PLANT: Principles of nuclear energy, basic components of nuclear reactions, nuclear power station.
Hydro electric station: Principles of working, applications, site selection, classification and arrangements, hydroelectric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems.

8 Hours

UNIT-5

NUCLEAR FUELS IN FISSION AND FUSION REACTORS, Types of nuclear reactors, Fissile and fertile materials, Neutron chain reaction in fission reactors, Neutron flux, Concept of criticality for bare homogeneous reactors, Coolants, moderators, Control and structural materials. Heat generations and steady state temperature distribution in fuel elements, Heat removal.

7 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Nuclear Reactor Engineering	S. Glastone and A . Sesonske.	Springer	4th	978-1-4615-2083-2
2.	Basic Nuclear Engineering	K.S. Ram.	South Asia Books		8122401309 978-8122401301
3.	Introduction to Nuclear Engineering	J.R lamarsh			978-0201824988 0201824981

S.No.	Title	Author	Publication	Edition	ISBN
4.	Power Plant Engineering	Mahesh Verma	Metropolitan Book Company Pvt. Ltd. New Delhi.		
5.	Power Plant Engineering	P.K. Nag	Tata McGraw Hill	4th	9339204042 9789339204044

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Steam & Gas Turbines & Power Plant Engineering	R.Yadav	Central Pub.House	7th	
2.	Power Plant Technology	El-Vakil	McGraw Hill.	2nd	0072871024 978-0072871029

Course Code: **TME 811 (ELECTIVE II)**   L T P C

Course Name: **VALUE ENGINEERING**   **3 0 0 3**

UNIT 1
AN OVERVIEW: Definition, value engineering recommendations, programmes, advantages.
APPROACH OF FUNCTION: Evaluation of function, determining function, classifying function, evaluation of costs, evaluation of worth, determining worth, evaluation of value.

8 Hours

UNIT 2
VE JOB PLAN: Introduction, orientation, information phase, speculation phase, analysis phase. Selection of Evaluation of VE Projects; Projects selection, Methods selection, value standards, application of VE methodology.

8 Hours

UNIT 3
VERSATILITY OF VE: VE operation in maintenance and repair activities, value engineering in non hardware projects.

8 Hours

UNIT 4
Initiating A VE Programme Introduction, training plan, career development for VE specialities.
Fast Diagramming Cost models, life cycle costs.

9 Hours

UNIT 5
VE LEVEL OF EFFORT: VE team, Co-ordinator, designer, different services, definitions, construction management contracts, value engineering case studies.

8 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	"Compendium on Value Engineering	Tufty Herald, G.	The Indo American Society	1st	-978-0-07-068193-4
2.	"Techniques of Value Engineering and Analysis	Miles, L.D	McGraw Hill	2nd	0070419264 9780070419261

REFERNCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Industrial Engineering and Management	O.P.KHANNA	Dhanpat Rai & Sons	21st	818992835X 9788189928353

Course Code: **TME 812 (OPEN ELECTIVE/ELECTIVE II)**   L   T   P   C
Course Name: **ADVANCED WELDING TECHNOLOGY**   **3   0   0   3**

UNIT 1
INTRODUCTION: Importance and application of welding, classification of welding process. Selection of welding process.
BRIEF REVIEW OF CONVENTIONAL WELDING PROCESS: Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS.CI, Al, Stainless steel & Maurer/Schaefflar Diagram. Soldering & Brazing.

9 Hours

UNIT 2
ADVANCED WELDING TECHNIQUES: Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

8 Hours

UNIT 3
ADVANCED WELDING TECHNIQUES (CONTINUED): Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spray-welding/ Metalizing, Hard facing.

8 Hours

UNIT 4
WELD DESIGN: Welding machines/equipments and its characteristics and arc-stability, Weld defects and distortion and its remedies, Inspection/testing of welds, Weld Design, Welding of pipe-lines and pressure vessels. Life predication.

8 Hours

UNIT 5
THERMAL AND METALLURGICAL CONSIDERATION: Thermal considerations for welding, temperature distribution, Analytical/Empirical analysis/formulae, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties.

9 Hours

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Welding and Welding Technology	Richard L. Little	McGraw-Hill		ISBN-10: 0070380953 ISBN-13: 978-0070380950

Course Code: **TME 813 (ELECTIVE II)**   L T P C
Course Name: **MECHANICAL VIBRATIONS**   **3 0 0 3**

UNIT 1

INTRODUCTION: Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, Fourier analysis

Single Degree Freedom System Free vibration, Natural frequency, Equivalent systems, Energy method for determining natural frequency, response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement.

9 Hours

UNIT 2

SINGLE DEGREE FREEDOM: Forced Vibration: Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments

8 Hours

UNIT 3

TWO DEGREE FREEDOM SYSTEMS: Introduction, Principal modes, Double pendulum, Torsional system with damping, coupled system, un damped dynamic vibration absorbers, Centrifugal pendulum absorbers, Dry friction damper

6 Hours

UNIT 4

MULTI DEGREE FREEDOM SYSTEM: Exact Analysis: Undamped free and forced vibrations of multi-degree freedom systems, influence number, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts

10 Hours

UNIT 5

MULTI DEGREE FREEDOM SYSTEM: Numerical Analysis: Rayleigh's, Dunkerely's, Holzer's and Stodola methods, Rayleigh-Ritz method

CRITICAL SPEED OF SHAFTS: Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed.

8 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Mechanical Vibrations	P. Srinivasan	TMH		0074519328, 9780074519325
2.	Mechanical Vibrations	G. K. Groover	Jain Brothers, Roorkee	8th	8185240566 9788185240565
3.	Mechanical Vibrations	W. T. Thomson	Prentice Hall	2nd	0-13-651068-X
4.	Mechanical Vibrations	Tse, Morse & Hinkle	Published by CBS Publishers & Distributors	2nd	8123908466 9788123908465
5.	Mechanical Vibrations	V. Rama Murthy	Narosa Publications		

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Mechanical Vibrations	W. T. Thomson	Prentice Hall	2nd	8120329007
2.	Mechanical Vibrations	Tse, Morse & Hinkle	Englewood Cliffs, N.J. : Prentice Hall	2nd	0205066704 0205059406
3.	Mechanical Vibrations	V. Rama Murthy	Narosa Publications		

Course Code: **TME 814 (ELECTIVE II)** L T P C
Course Name: **MAINTENANCE & SAFETY MANAGEMENT** **3 0 0 3**

UNIT 1
INTRODUCTION: Operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability

5 Hours

UNIT 2
MAINTENANCE STRATEGIES: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency.

8 Hours

UNIT 3
REPLACEMENT PLANNING &MAINTAIN OR REPLACE DECISION: Replacement of items that deteriorate with time identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning.

9 Hours

UNIT 4
SAFETY IN ENGINEERING INDUSTRY: definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage,. disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection. Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks , clamps general safety consideration in material handling - manual and mechanical handling . Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents.

12 Hours

UNIT 5
MAINTENANCE MANAGEMENT, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management.

8 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Management of systems	R.N. Nauhria & R. Prakash.	Dhanpat Rai & Sons		9780136077282

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Industrial Safety Handbook	William Handley	McGraw-Hill,		007084481X 9780070844810
2.	Introduction to Safety Engineering	David S Gloss & Miriam GayleWardle	Wiley-Interscience	1st	ISBN-13: 978-0471876670 ISBN-10: 0471876674
3.	Industrial Safety	Roland P Blake.	Prentice-Hall, Inc. (1943)	3rd	0134631331

4.	Health and Safety in Welding and allied process	N C Balchin,Jaico publishers.	Jaico Publishing House		ISBN-10: 8172244479 ISBN-13: 978-8172244477

Course Code: **TME 821 (ELECTIVE III)**   L T P C
Course Name: **MECHANICAL SYSTEM DESIGN**   **3 0 0 3**

UNIT 1
ENGINEERING PROCESS AND SYSTEM APPROACH: Basic concepts of systems, Attributes characterizing a system, system types, Application of system concepts in Engineering, Advantages of system approach, Problems concerning systems, Concurrent engineering, A case study-Viscous lubrication system in wire drawing
PROBLEM FORMULATION: Nature of engineering problems, Need statement, hierarchical nature of systems, hierarchical nature of problem environment, problem scope and constraint, A case study: heating duct insulation system, high speed belt drive system

10 Hours

UNIT 2
SYSTEM THEORIES : System Analysis, Black box approach, state theory approach, component integration approach, Decision process approach, A case study- automobile instrumentation panel system.
SYSTEM MODELLING: Need of modelling, Model types and purpose, linear systems, mathematical modelling, concepts, A case study compound bar system

8 Hours

UNIT 3
GRAPH MODELLING AND ANALYSIS: Graph Modelling and analysis process, path problem, Network flow problem, A case study: Material handling system
OPTIMIZATION CONCEPTS: Optimization processes, Selection of goals and objectives-criteria, methods of optimization, analytical, combinational, subjective. A case study: aluminium extrusion system.

8 Hours

UNIT 4
SYSTEM EVALUATION: Feasibility assessment, planning horizon, time value of money, Financial analysis, A case study: Manufacture of maize starch system
CALCULUS METHOD FOR OPTIMIZATION: Model with one decision variable, model with two decision variables, model with equality constraints, model with inequality constraints, A case study: Optimization of an insulation system.

8 Hours

UNIT 5
DECISION ANALYSIS: Elements of a decision problem, decision making, under certainty, uncertainty risk and conflict probability, density function, expected monetary value, Utility value, Baye's theorem, A case study: Installation of machinery.
SYSTEM SIMULATION: Simulation concepts, simulation models, computer application in simulation, spread sheet simulation, Simulation process, problem definition, input model construction and solution, limitation of simulation approach, A case study: Inventory control in production plant.

13 Hours

TEXT BOOKS :

S.No.	Title	Author	Publication	Edition	ISBN
1.	Design and Planning of Engineering systems	-DD Reredith, KV Wong, RW Woodhead, and RR Worthman	Prentice Hall Inc., Eaglewood Cliffs, New Jerse		
2	Design Engineering	JR Dixon	TMH, New Delhi		

REFERNCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	An Introduction to Engineering Design Method	V Gupta and PN Murthy	TMH, New Delhi	1st	0070964416, 9780070964419
2.	Engineering Design	Robert Matousck	Blackie and son ltd. Glasgow	2nd	9783540199175
3.	Optimization Techniques	SS Rao	John Wiley & Sons, 1996		0471550345, 9780471550341
4.	System Analysis and Project Management	Devid I Cleland, William R King	McGraw Hill.	3rd	ISBN-13: 978-0070113114 ISBN-10: 0070113114

Course Code: **TME 822 (ELECTIVE III)**   L   T   P   C

Course Name: **EXPERIMENTAL STRESS ANALYSIS**   **3   0   0   3**

UNIT 1
ELEMENTARY ELASTICITY: STRESS: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Coordinate System, Special States of Stress.
STRAIN: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State of Stress.

9 Hours

UNIT 2
STRAIN MEASUREMENTS: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid- Method of Strain Analysis.
BRITTLE COATING METHOD: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data.

9 Hours

UNIT 3
ELECTRICAL RESISTANCE STRAIN GAGES: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor.
STRAIN GAGE CIRCUIT: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges.
ANALYSIS OF STRAIN GAGE DATA: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, Plane Shear-Gage.

8 Hours

UNIT 4
THEORY OF PHOTO ELASTICITY: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polaris cope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polaris cope, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors.

9 Hours

UNIT 5
TWO DIMENSIONAL PHOTO ELASTICITY : Introduction, Iso chromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for Two-Dimensional Photo elasticity.

7 Hours

TEXT BOOKS:

S. No	Title	Author	Publication	Edition	ISBN
1.	Experiment Stress Analysis	James W. Dally and William F. Riley	International Student Edition, McGraw-Hill Book Company	2nd	0070152047, 9780070152045

REFERENCE BOOKS:

S.No	Title	Author	Publication	Edition	ISBN
1.	Experiment Stress Analysis,	Dr. Sadhu Singh	Khanna Publishers.	1st	8174091823 9788174091826

Course Code: **TME 823 (ELECTIVE III)**   L T P C
Course Name: **INDUSTRIAL ERGONOMICS**   **3 0 0 3**

UNIT 1
INTRODUCTION: Importance applications and principles of occupational ergonomics.
PHYSIOLOGICAL PRINCIPLES: Muscular work, Nervous control of movements, Improving working efficiency. Optimal use of muscle strength. /Guidelines for work layout.
SKILLED WORK: Acquiring skill, control of skilled movements. Design of tools and equipments for skilled work.
6 Hours

UNIT 2
HEAVY WORK: Energy consumption, Efficiency, Heart rate as a measure of workload.
WORK-STATION DESIGN: Anthropometric data, Reach and clearance dimensions. Percentiles to be accommodated.
6 Hours

UNIT 3
WORKING HEIGHTS: Comfortable working postures. Room to grasp or move things, and operate controls. Sedentary work. Its advantages, disadvantages and limitation. Sedentary workplace design. Design of VDT workstations, Design of Key board.
HANDLING LADS: The Human spine, back troubles associated with industrial work, Inter vertebral disc, disc pressure, slip of disc, Bio-mechanical models of lower back. Recommendations for handling loads.
MAN-MACHINE SYSTEM: Display equipment, Controls, Relation between control and display instruments, Mental activity, Fatigue, Occupational stress, Job design in monotonous task.
10 Hours

UNIT 4
HUMAN VISUAL SYSTEM: Accommodation, Aperture of the pupil, Adaptation of reline, eye movements Visual capacity, Visual strain, Physiology of reading.
ERGONOMIC PRINCIPLES OF LIGHTING: Light sources, measurement, physiological requirements of artificial lighting, arrangement of light. Light for fine work and for VDT offices.
9 Hours

UNIT 5
NOISE AND VIOLATION: Sound perception, Noise load, damage to hearing, physiological and psychological effects of noise. Protection against noise, Vibrations and their effect on performance.
WORKING ENVIRONMENT: Thermo-regulation in human body, comfort indoors, Air quality and its dryness, Air pollution and ventilation. Heat in industry Recommendations for comfort indoors. Daylight, colors and music for pleasant work environment.
10 Hours

TEXT BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Fitting the task to the Man	E. Gandjean, Taylor and Francis	Taylor & Francis, 1980	3rd	0850661927, 9780850661927
2.	A guide to Ergonomics of Manufacturing	Helander, M.	East-West Press.	2nd	0748401229

REFERENCE BOOKS:

S.No.	Title	Author	Publication	Edition	ISBN
1.	Human Factor in Engineering and Design, Sanders	Sanders, M.S., and Mc Cormik, E.J.,	Mc Graw.Hill	7th	9780070549012

Course Code: **PME 801**   L T P C
Course Name: **AUTOMOBILE ENGINEERING LAB**   **0 0 3 2**

Experiments: Say minimum 12 experiments out of following.

1. Performance Analysis of Four stroke S.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.

2. Determination of Indicated H.P. of I.C. Engine by Morse Test.

3. Performance Analysis of Four stroke C.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.

4. Study & experiment on Valve mechanism.

5. Study & experiment on Gear Box.

6. Study & experiment on Differential Gear Mechanism of Rear Axle.

7. Study & experiment on Steering Mechanism.

8. Study & experiment on Automobile Braking System.

9. Study & experiment on Chassis and Suspension System.

10. Study & experiment on Ignition system of I.C. Engine.

11. Study & experiment on Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.

12. Study & experiment on Fuel Supply System of C.I. Engines- Injector & Fuel Pump.

13. Study & experiment on Air Conditioning System of an Automobile.

14. Comparative study of technical specifications of common small cars (such as Maruti Swift, Hyundai i20, Cheverlet Aveo, Tata Indica, Ford Fusion etc

15. Comparative study & technical features of common scooters & motorcycles available in India.

16. Visit of an Automobile factory.

17. Visit to a Modern Automobile Workshop.

18. Experiment on Engine Tuning.

19. Experiment on Exhaust Gas Analysis of an I.C. Engine.

Course Code: **PME 802**   L T P C
Course Name: **PROJECT PHASE II**   **0 0 12 6**

STUDENTS ARE REQUIRED TO SUBMIT THE PROJECT WORK , ON THE TOPIC SELECTED IN PROJECT PHASE I.

THE STUDENTS ARE REQUIRED TO SUBMIT THE PROJECT REPORT & MODEL PREPARED BY THEM. THEY ARE ALSO APPEAR FOR THE FINAL VIVA VOCE FOR THE PROJECT