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:
1. Engineering Mathematics by B.S. Grewal, Khanna Publishers
2. Higher Engineering Mathematics by B.V. Ramana (Tata-McGraw Hill)

REFERENCE BOOKS:
3. Kreyszig, Erwin. "Advanced Engineering Mathematics", 9e, Wiley Publications, 2006
4. Bali, N. P., Narayana Iyengar, N. Ch., "A Text Book of Engineering Mathematics", 6e, Laxmi Publication, India, 2003
5. Advanced Modern Engineering Mathematics by Glyn James (Pearson Education)

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

UNIT 1:
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:
Concepts of stress and strain, 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, and 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.
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 10 Hours

UNIT 5:
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. 6 Hours

TEXT BOOKS:

1. "Materials Science and Engineering- An Introduction", William D.Callister Jr. Wiley India Pvt. Ltd. New Delhi.
2. "Essentials of Materials For Science And Engineering", Donald R. Askeland, Pradeep P. Phule Thomson-Engineering.

REFERENCE BOOKS:

1."Introduction to Material Science for Engineering", 6th edition James F. Shackel ford. Pearson, Prentice Hall, New Jersy, 2006.
2."Physical Metallurgy, Principles and Practices", V Raghavan.PHI, NewDelhi.
3."Foundation of Material Science and Engineering", Smith, 3rd Edition McGraw Hill.

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, Principle of super position 8 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), 9 Hours

UNIT 3:
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 8 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:

1. "Mechanics of Materials" by R.C.Hibbeler, Printice Hall, Pearson Edu., 2005
2. "Mechanics of materials", James.M.Gere, Tho.mson, Fifth edition 2004.
3. "Mechanics of materials", S.I. Units, Ferdinand Beer and Russell Johnstan, TATA Mac GrawHill-2003.

REFERENCE BOOKS:

1. "Strength of Materials", S.S.Bhavikatti, Vikas publications House – Pvt. Ltd., 2nd Ed., 2006.
2. "Mechanics of materials" K.V. Rao, G.C. Raju, First Edition,2007
3. "Engineering Mechanics of Solids" Egor.P. Popov, Pearson Edu. India, 2nd,Edition

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

UNIT 1:
Fundamental Concepts & 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. 6 Hours

UNIT 2:
Work & Heat: Thermodynamic definition of work; examples, sign 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-steady 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 Thermodynamic; PMM I and PMM II. Clausius's statement of Second law of Thermodynamic; 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, principle 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.
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. 9 Hours

UNIT 5:
Real and ideal gases: Introduction; Vander Waal's Equation, law of corresponding states, universal and particular gas constants, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy, enthalpy and entropy in various quasi-static processes. Ideal gas mixture; Dalton's law of additive pressures. 9 Hours

TEXT BOOKS:

1. "Basic and Applied Thermodynamics" by P .K. Nag, Tata McGraw Hill, 3rd Edi. 2002
2. "Thermodynamics an engineering approach", by Yunus A. Cenegal and Michael A. Boles. Tata McGraw hill Pub. 2002

REFERENCE BOOKS:

1. Engineering Thermodynamics. By Rajput, Laxmi Publications pvt ltd., 3rd Edi. 2007.
2. Engineering Thermodynamics by J.B. Jones and G.A.Hawkins, John Wiley and Sons.
3. Thermo Dynamics by S.C.Gupta, Pearson Edu. Pvt. Ltd., 1st Ed. 2005.

Course Code: **TME 305** L T P C
Course Name: **MANUFACTURING PROCESSES I** **3 1 0 4**

UNIT-1

Introduction: Importance of manufacturing. Economic and technological considerations in manufacturing. Classification of manufacturing processes. Materials and manufacturing processes for common items. 4 Hours

UNIT-2

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 and disc. Work required for forging, Hand, Power, Drop Forging Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application. Condition for Rolling force and power in rolling. Rolling mills and rolled-sections. Design, lubrication and defects in metal forming processes. 10 Hours

UNIT-3

Sheet Metal : 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-4

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

Jigs and Fixtures : Locating and Clamping devices and principles. Jigs and Fixtures and its applications.

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. 10 Hours

UNIT-5

Casting (Foundry): 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, Runnes, Core. Solidification of casting,. Sand casting, defects and remedies and inspection. Cupola furnace. Die Casting, Centrifugal casting. Investment casting, and Stir casting etc. 10 Hours

TEXT BOOKS :

1. Manufacturing Science by Ghosh and Mallik
2. Production Engg. Science by P.C. Pandey
3. Production Technology by R.K. Jain

REFERENCE BOOKS:

1. Manufacturing Technology by P.N. Rao., TMH
2. Materials and Manufacturing by Paul Degarmo.
3. Manufacturing Engineering and Technology by Kalpakjian, Pearson Pubublication

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.

PART – A

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.

PART – B

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)

PART – C

UNIT 5:

Assembly Drawings (Part drawings should be given)

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

TEXT BOOKS

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat and V.M.Panchal
3. 'Machine Drawing' , N. Siddeshwar, P. Kanniah, V.V.S. Sastri,published by Tata Mc GrawHill,2006

REFERENCE BOOKS

1. 'A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007
2. 'Machine Drawing' , K.R. Gopala Krishna, Subhash Publication.
3. 'Machine Drawing with Auto CAD'. Goutam Pohit and Goutham Ghosh, 1st Indian print Pearson Education, 2005
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**

Note: ***Students are required to perform 8 experiments.***

1. Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze and composites.

2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.

3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.

4. Non-destructive test experiments like,
   (a). Ultrasonic flaw detection
   (b). Magnetic crack detection
   (c). Dye penetration testing, to study the defects of Casted and Welded specimens.

5. Tensile, shear and compression tests of metallic and non metallic specimens using a Universal Testing Machine.

6. Torsion tests.

7. Bending Test on metallic and nonmetallic specimens.

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

9. Brinell, Rockwell and Vickers's Hardness test.

10. Fatigue Test.

Course Code: **PME 313** L T P C

Course Name: **FOUNDRY AND FORGING LAB** **0 0 3 2**

Note : ***Students are required to perform minimum 8 experiment out of the list.***

1. Preparation of casting mould using two moulding boxes by Using pattern (simple type). Without pattern.
2. To demonstrate the Casting process(Aluminum parts).
3. To determine grain fineness number of a given sand sample(Sieve Analysis Test).
4. To prepare the upset forging process to make a simple parts
5. To perform forging operation of a sample by using power hammer.
6. To determine amount of clay content in a given sand sample.
7. To determine moisture content in a given sand sample.
8. To perform permeability test for a given sand sample.
9. To perform compression Shear and Tensile test of a given sand sample in universal Sand Testing Machine.
10. To determine hardness of core and 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. 9 Hours

UNIT 2:

VAPOUR POWER CYCLES: -Carnot vapour 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 vapour power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle. 8 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. 7 Hours

UNIT 4:

REFRIGERATION: -Vapour compression refrigeration system; description, analysis, refrigerating effect, capacity, power required, units of refrigeration, COP. Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle. Vapour absorption refrigeration system. Steam jet refrigeration.

PSYCHROMETRICS: - Atmospheric air and psychrometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidifies and the relation between the two Enthalpy and adiabatic saturation temperature. Construction and Use of psychometric chart. Analysis of various processes; heating, cooling, dehumidifying and humidifying. Adiabatic mixing of stream of moist air. Summer and winter air - conditioning.

12 Hours

UNIT 5:

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

6 Hours

TEXT BOOKS:

1. Basic and Applied Thermodynamics by P.K.Nag, Tata McGraw Hill Pub. Co..
2. Fundamental of Classical Thermodynamics by G.J. Van Wylen and R.E.Sonntag, Wiley Eastern.

REFERENCE BOOKS:

1. Thermodynamics -An Engineering Approach by Yunus, A.Cenegal and Michael A.Boles, Tata McGraw Hill Pub. Co.
2. Applied Thermodynamics by R.K.Hegde and Niranjan Murthy, Sapna Book House

Course Code: **TME 402** L T P C
Course Name: **INDUSTRIAL ENGINEERING** **3 0 0 3**

UNIT 1:

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.

Productivity, Definition of productivity, factors affecting productivity definition, objective and scope of productivity. 6 Hours

UNIT 2:

Work study, human factors in work study, work study and management, work study and supervisor, work study andworker.

INTRODUCTION TO 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.(With simple problems)

MICRO AND MEMO MOTION STUDY: Charts to record moment at work place – principles of motion economy, classification of moments two handed process chart, SIMO chart, and micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies 9 Hours

UNIT 3:

INTRODUCTION TO WORK MEASUREMENT: Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems

TIME STUDY: Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. 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) 12 Hour

UNIT 4:

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 7 Hours

UNIT 5:

MATERIALS MANAGEMENT: Objectives and functions, Purchasing function, Purchasing procedure, Make or buy decisions, simple break even analysis, Obsolete, Scrap and surplus management, Inventory Control, Need of inventory control, types of inventory.

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:

1. Industrial Engineering – Mahajan and Sahani, Dhanpat Rai Publication.
2. Industrial Engineering – Martand Telseng, S. Chand Publication.
3. Mechanical estimating and Costing – T R banga, S C Sharma, Khanna Publishing house
4. Work study, ILO, 3rd edition.Materials

REFERENCE BOOKS:

1. Human Factors in Engineering Design - S Sanders and E J McCormick, 6th Edition, Mc Graw Hill
2. Work Study and Ergonomics - S Dalela and Sourabh, – Chand Publishers, 3rd edition.
3. Industrial Engineering Hand book Maynard
4. Motion and Time study - Ralph M Barnes; John Wiley, 8th Edition, 1985

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

UNIT 1:

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, Taylor's tool life equation, problems on tool life evaluation.

7 Hours

UNIT 2:

Cutting tool materials: Desired properties, types of cutting tool materials – HSS, carbides coated carbides, ceramics 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.

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.

9 Hours

UNIT 3:

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.

Shaper and Planer Machines : Classification, constructional features, nomenclature of tooling, operation and comparison of both. Operations on shaper and Planer machines.

Indexing of Machine mechanisms : Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.

11 Hours

UNIT 4:

Grinding machines: Types of abrasives, bonding process, classification, constructional features (cylindrical and surface grinding), selection of grinding wheel. Lapping and Honing machines: Principles of operation, construction, applications. 5 Hours

UNIT 5

Welding operations: survey 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 andMIG 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:

1. Workshop Technology by Hazara Choudhry,Vol-II, Media PromotersandPublishers Pvt.Ltd. 2004
2. Production Technology by R.K.Jain, Khanna Publications, 2003.
3. Production technology by HMT, Tata MacGraw Hill, 2001.

REFERENCE BOOKS:

1. Manufacturing Science by Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. Fundamentals of Metal Machining and Machine Tools by G. Boothroyd, McGraw Hill, 2000.
3. Materials and their Processing by Paul De Garmo and Black

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

UNIT 1:

Standards of measurement: Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-112), Numerical problems on building of slip gauges. 6 Hours

UNIT 2:

System of limits, Fits, Tolerances and gauging: Definition of tolerance, Specification in assembly, Principle of inter changeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919 -1963), geometrical tolerance, positional - tolerances, hole basis system, shaft basis of system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges -plain plug gauge, ring Gauge, snap gauge, limit gauge and gauge materials. 9 Hours

UNIT 3:

Comparators and Angular measurement: Introduction to Comparator, Characteristics, classification of comparators, mechanical comparators -Johnson Mikrokator, Sigma Comparators, dial indicator, Optical Comparators -principles, Zeiss ultra optimeter, Electric and Electronic Comparators -principles, LVDT, Pneumatic Comparators, back pressure gauges, Solex Comparators. Angular measurements, Bevel Protractor, Sine Principle and. use of Sine bars, Sine center, use of angle gauges, numerical on building of angles) Clinometers.

Interferometer and Screw thread gear measurement : Interferometer Principle of interferometer, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, Best size wire. Toolmakers microscope, gear terminology, use of gear tooth Vernier caliper and gear tooth micrometer. 9 Hours

UNIT 4:

Measurements and Measurement systems: Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hystersis, repeatability, linearity, loading effect, system response-times delay. Errors in Measurements, Classification of Errors. Transducers, Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, advantages of each type transducers.

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, Electrical intermediate modifying devices, input circuitry, ballast, ballast circuit, electronic amplifiers and telemetry. Terminating devices, Mechanical, Cathode Ray Oscilloscope, Oscillographs, X-Y Plotters. 9 Hours

UNIT 5:

Measurement of Force and Torque, pressure: Principle, analytical balance, platform balance, proving ring, Torque measurement, Prony brake, hydraulic dynamometer. Pressure Measurements, Principle, use of elastic members, Bridgeman gauge, Mcloed gauge, Pirani Gauge.

Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, Optical Pyrometer. Strain Measurements, Strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement . 9 Hours

TEXT BOOKS:

1 "Mechanical measurements" byBeckwith Marangoni and Lienhard,Pearson Education,6th Ed. 2006
2. "Engineering Metrology" by R.K.Jain, Khanna Publishers, 1994.

REFERENCE BOOKS:

1. "Engineering Metrology" by I.C.Gupta, Dhanpat Rai Publications, Delhi
2. "Mechanical measurements" by R.K.Jain
3. "Measurement Systems Applications and Design" by Ernest O, Doblin, McGRAW Hill Book

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:

1. "Theory of Machines", Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2nd edition -2005.
2. "Theory of Machines", Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2ND Edi. 2006.

REFERENCE BOOKS:

1. "Theory of Machines and Mechanisms" , Shigley. J. V. and Uickers, J.J., OXFORD University press.2004
2. "Theory of Machines -I", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004

Course Code: **PME 411** L T P C

Course Name: **MACHINE SHOP** **0 0 3 2**

Note : Students are required to perform minimum 10 experiments out of these 12 experiments.

1. Lathe machine operations : Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, on given specimens.
2. Gear cutting on Milling machine.
3. Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
4. Finishing of a given surface on surface-grinding machine.
5. Drilling a hole, and Counter drilling operation on a given specimen.
6. Designing a Jig /Fixtures for a given component .
7. Arc welding experiment.
8. Resistance Spot welding experiment.
9. Experiment on GAS welding.
10. Experiment on GAS Cutting.
11. Experiment on TIG Welding
12. Experiment on MIG Welding

Course Code: **PME 412** L T P C

Course Name: **APPLIED THERMODYNAMICS LAB** **0 0 3 2**

Note : Students are required to perform minimum 8 experiments out of these 10 experiments.

THREE CYLINDER FOUR STROKE PETROL ENGINE TEST RIG

1. To determine specific fuel consumption; Brake Horse Power and Brake Thermal Efficiency
2. To determine mechanical efficiency and indicated thermal efficiency
3. To perform MORSE TEST, on above engine test rig.

SINGLE CYLINDER FOUR STROKE WATER COOLED DIESEL ENGINE TEST RIG

4. To determine specific fuel consumption and Brake Horse Power.
5. To determine volumetric efficiency measurement and Brake Thermal Efficiency

SINGLE CYLINDER TWO STROKE PETROL ENGINE TEST RIG

6. To determine Brake Power and fuel consumption.
7. To determine specific fuel consumption and Brake Thermal Efficiency.
8. To find the dryness fraction of steam by using a SEPARATING and THROTTLING CALORIMETER.
9. To study the Vapour absorption refrigeration cycle and To Calculate Co-efficient of performance- (COP)by using a REFRIGERATION TEST RIG (Vapour Absorption system)
10. To study the Vapour Compression air conditioning cycle and To Calculate Co-efficient of performance- (COP) by the use of P-H diagram, by using AIR-CONDITIONER TEST RIG (Vapour compression system)

Study and Demonstration of different cut section associated with theory curriculum.

Course Code: **PME 413** L T P C

Course Name: **MEASUREMENT and METROLOGY LAB** **0 0 3 2**

Note : Students are required to perform 8 experiments out of the list.

PART – A

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load Cell
5. Calibration of micrometer using slip gauges.
6. Determination of modulus of elasticity of a mild steel sample using strain gauges.

PART – B

1. Measurement using optical projector/ tool maker's microscope
2. Measurement of angle using Sine centre/ Sine Bar / Bevel Protector
3. Measurement of alignment using autocollimeter / roller set
4. Measurement of cutting tool forces using
    a) Lathe tool dynamometer
    b) Drill tool dynamometer
5. Measurement of screw thread parameters using two wire or three wire method.
6. Measurement of surface roughness using tally surf / mechanical comparator.
7. Measurement of gear tooth profile using gear tooth Vernier / gear tooth micrometer.
8. Measurement using optical flats.