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; Analogy of Heat flow rate with electric current flow.

CONDUCTION: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. 8 Hours

UNIT - 2

VARIABLE THERMAL CONDUCTIVITY: Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal 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.

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:

1. Heat and Mass transfer, Tirumaleshwar, Pearson education 2007
2. Heat transfer-A basic approach, Ozisik, Tata Mc Graw Hill 2006

REFERENCE BOOKS:

1. Heat transfer, a practical approach, Yunus A- Cengel Tata Mc Graw Hill
2. Principles of heat transfer, Kreith Thomas Learning 2001
3. Fundamentals of heat and mass transfer, Frenk P. Incropera and David P. Dewitt, John Wiley and son's.
4. Heat transfer, P.K. Nag, Tata Mc Graw Hill 2002.

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 Casing Processes **:** Introduction, Process principle of Metal mould casting, Continuous casting, Squeeze casting, Vacuum mould casting, Evaporative pattern casting, Ceramic shell casting, Vacuum Assisted Evaporative Pattern Casting Process(VAEPC). 10 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 5 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). 9 Hours

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. 9 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. 7 Hours

TEXT BOOK :

1 Advance Manufacturing Processes By Viney Kumar Singh
2 Manufacturing Technology Vol I and II By P N Rao

REFERENCE BOOKS :

1. Materials and Manufacturing processes By Paul De Garmo.

Course Code: **TME 503** L T P C

Course Name: **DESIGN OF MACHINE ELEMENTS – I** **3 1 0 4**

UNIT 1:

Introduction: Definitions: Normal, Shear, Biaxial and Tri Axial Stresses, Principal Stresses. Engineering Materials and their Mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards**.**

Design for Static and Impact Strength: 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. 8 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: 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. 7 Hours

UNIT 5:

Riveted and Welded Joints: Types, Rivet Materials, Failures of Riveted Joints, Joint Efficiency, Boiler Joints, Tank and Structural Joints, 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). 9 Hours

DESIGN DATA HAND BOOKS:

1. Design Data Hand Book – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
2. Design Data Hand Book – K. Mahadevan and Balaveera Reddy, CBS Publication
3. Machine Design Data Hand Book – H.G. Patil, ShriShashiPrakashan, Belgaum.
4.PSG Design Data Handbook PSG College of Technology, Coimbatore.

TEXT BOOKS:

1. Mechanical Engineering Design: Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.

2. Design of Machine Elements: V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

REFERENCE BOOKS:

1. Machine Design: Robert L. Norton, Pearson Education Asia, 2001.

2. Design of Machine Elements: M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006

3. Machine Design: Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani,Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 200 8

4. Fundamentals of Machine Component Design: Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

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. 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**.**

Analysis of CAMS: Analysis of Tangent Cam with Roller Follower and Circular Arc Cam Operating Flat Faced and Roller Followers, Undercutting in Cams. 10 Hours

TEXT BOOKS:

1. Theory of Machines: Sadhu Singh, Pearson Education, 2nd edition, 2007.
2. Theory of Machines: Rattan S.S. Tata McGraw Hill Publishing Company Ltd.,New Delhi, 2nd Edition, 2006.
3. Theory of Machines: R.S Khurmi. S Chand publication Company Ltd.,New Delhi

REFERENCE BOOKS:

1. Theory of Machines, Thomas Bevan, CBS Publication 1984.
2. Design of Machinery, Robert L. Norton, McGraw Hill, 2001.
3. Mechanisms and Dynamics of Machinery, J. Srinivas, Scitech Publications, Chennai

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' 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 sublayer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect. 9 Hours

TEXT BOOKS :

1. S Narasimhan : First Course in Fluid Mechanics , University Press
2. Som, S.K. and Biswas G. : Introduction of fluid mechanics and Fluid Machines, TMH, 2000, 2nd edition
3. M M Das : Fluid Mechanics and Turbomachines , Oxford University Press

REFERENCE BOOKS :

1. S.K.Agarwal : Fluid Mechanics and Machinery, TMH
2. Garde, R.J., " Fluid Mechanics through Problems", New Age International Pvt. Ltd, New Delhi, 2nd Edition.
3. Hunter Rouse, "Elementary Mechanics of Fluids", John Wiley and Sons. Omc. 1946
4. I.H.Shames, "Mechanics of Fluids", McGraw Hill, Int. Student, Education, 1988.
5. Fluid Mechanics by Jagdish Lal
6. Vijay Gupta and S.K.Gupta, " Fluid Mechanics and its Applications", Wiley Eastern Ltd, 1984.
7. Modi, P.N., and Seth, S.H., "Hydrualics and Fluid Machines", Standard Book House, 1989.

Course Code: **PME 511** L T P C

Course Name: **HEAT and MASS TRANSFER LAB** **0 0 3 2**

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

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. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
5. Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.
6. Determination of Emissivity of a Surface.
7. Determination of Stefan Boltzman Constant.
8. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers
9. Experiments on Boiling of Liquid and Condensation of Vapour
10. Experiment on Transient Conduction Heat Transfer

Course Code: **PME 512** L T P C

Course Name: **FLUID MECHANICS LAB** **0 0 3 2**

Note: Students are required to perform minimum **8** experiments from the list.

1. Determination of the coefficient of impact for vanes.
2. Determination of coefficient of discharge of an orifice meter.
3. Determination of coefficient of discharge of Notch (V and Rectangular types).
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.

Course Code: **PME-513** L T P C

Course Name: **DYNAMICS OF MACHINES LAB** **0 0 3 2**

Note: Students are required to perform minimum **8** experiments, **including** any **one** study based learning.

1. To perform experiment on watt and porter Governors to prepare performance characteristics Curves and to find stability and sensitivity.
2. To perform experiment on Proell Governor to prepare performance characteristics Curves and to find stability and sensitivity.
3. To perform experiment on Hartnell Governor to prepare performance characteristics Curves and to find stability and sensitivity.
4. To Determine gyroscopic couple on Motorized Gyroscope.
5. To perform Experiment on Static and Dynamic Balancing.
6. To perform Experiment on CAM movement and profile plotting.
7. To perform Experiment on critical speed of Whirling shafts.
8. To determine the Moment of Inertia of a Flywheel about its own axis of rotation.

Study Based Learning

9. Study of various mechanisms with the help of Models.
10. Study of various links with the help of Models.
11. Study and draw various inversions of 4- bar chain and single slider crank chain and Draw velocity and diagram of basic 4- bar mechanism using graphical methods including Klien's construction.
12. Study of Gear Train mechanisms and calculations of number of teeth.

Course Code: **TME-601** L T P C

Course Name: **REFRIGERATION AND AIR CONDITIONING** **3 1 0 4**

UNIT 1

Methods of refrigeration: Ice refrigeration, evaporative refrigeration, air refrigeration, vapour refrigeration, dry ice refrigeration, thermo electric refrigeration, pulse tube refrigeration, thermo acoustic refrigeration.

Gas cycle refrigeration: Introduction , reverse Carnot cycle, Bell Coleman cycle, advantages and disadvantages of gas refrigeration system. Applications to aircraft refrigeration, Analysis of gas refrigeration and Numerical . 8 Hours

UNIT 2

Multi pressure vapour compression systems: Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid carbon dioxide, System practices for multistage system.

Refrigerants: Types of Refrigerants, Comparative study of Ethane and Methane derivatives, selection of Refrigerants, Requirements of Refrigerants, Effects of lubricants in Refrigerants, substitutes of CFC Refrigerants, Mixture Refrigerants-azeotropic mixtures.

8 Hours

UNIT 3

Equipments 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. 8 Hours

UNIT 4

Vapour absorption system: Common refrigerant absorbent combinations, Binary mixtures, Ammonia Water Absorption system, Actual vapour absorption cycle and its representation on enthalpy. composition diagram, calculations. Triple fluid vapour absorption refrigeration system. Water - Lithium Bromide absorption chiller.

Load calculations and applied psychometrics: Internal heat gains, system heat gains, break up of ventilation load and effective sensible heat factor, Bypass factor, cooling load estimate. Psychometric calculations for cooling. Selection of Air conditioning apparatus for cooling and dehumidification, evaporative cooling. 10 Hours

UNIT 5

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. 8 Hours

TEXT BOOKS:

1. 'Refrigeration and Air-Conditioning' C. P. Arora, Tata McGraw Hill Publication.
2. 'Refrigeration and Air-Conditioning' W. F. Stoecker, Tata McGraw Hill Publication.

REFERENCE BOOKS:

1. 'Principles of Refrigeration' Dossat, Pearson-2010.
2. 'Heating, Ventilation and Air Conditioning', McQuistion, Wiley Students edition,2009
3. 'Air conditioning' PITA, 4th edition, pearson-2010
4. 'Refrigeration and Air-Conditioning' Manohar prasad
5. 'Refrigeration and Air-Conditioning' S C Arora and S Domkundwar, Dhanpat Rai Publication

Course Code: **TME-602** L T P C

Course Name: **DESIGN OF MACHINE ELEMENTS-II** **3 1 0 4**

UNIT 1:

Curved beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses and clamps, closed rings and links

Cylinders and cylinder heads: Review of Lame's Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats. 8 Hours

UNIT 2:

Belts ropes and chains: Flat belts: Length and cross section, Selection of V-belts, ropes and chains for different applications.

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. 9 Hours

UNIT 3:

Spur and helical 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 and worm 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 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.

Lubrication and bearings: Lubricants and their properties, Mechanisms of Lubrication bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials, Examples of journal bearing and thrust bearing design. 10Hours

UNIT 5:

IC engine parts: Design of piston, connecting rod and crank shaft. 5 Hours

DESIGN DATA HANDBOOK:

1. Design Data Hand Book , K. Lingaiah, McGraw Hill, 2nd Ed.
2. Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS Publication
3. Design Data Hand Book, H.G. Patil, Shri Shashi Prakashan, Belgaum

TEXT BOOKS:

1. Mechanical Engineering Design, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition.
2. Design of Machine Elements, V. B Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOKS:

1. Machine Design, Robert L. Norton, Pearson Education Asia.

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 & CO2 , 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, air consumption, fuel consumption, heat carried by cooling water, heat carried by the exhaust gases, heat balance sheet, governing of I.C. Engines 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:

1. IC Engines By R.K. Rajput-Laxmi Publication
2. IC Engines By M.L Mathur and R.P Sharma –Dhanpat Rai Publication

REFERENCE BOOKS:

1. Internal Combustion Engines by V. Ganesan, Prentice Hall of India
2. A Course in Internal Combustion Engines by Damundwar by Dhanpath Rai and Sons
3. Johan B. Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill Book Co., New York
   Richard Stone, "Introduction to Internal Combustion Engines", 3rd Edition, MACMILAN, New York
4. Willard. Pulkrabek, "Engineering Fundamental of Internal Combustion Engine", Prentice Hall International, Inc., New York

Course Code: **TME 604** L T P C

Course Name: **FLUID MACHINERY** **3 1 0 4**

UNIT 1:

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Static and Stagnation states- Incompressible fluids and perfect gases, Application of first and second law's of thermodynamics to turbo machines, Efficiencies of turbo machines. Problems.

Energy exchange in turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems. 10 Hours

UNIT -2:

General analysis of turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems. 6 Hours

UNIT –3:

Dimensionless analysis and thermodynamics of fluid flow: Dimensionless parameters and their significance, Effect of Reynolds's number, Unit and specific quantities, model studies. Overall isentropic efficiency, stage efficiency (their comparison) and polytropicefficiency for both compression and expansion processes. Reheat factor for expansion process. 6 Hours

UNIT –4:

Steam turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor, Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problem

Hydraulic turbines: Classification, Different efficiencies, Pelton turbine – velocity triangles, design parameters, Maximum efficiency. Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. Kaplan and Propeller turbines - velocity triangles, design parameters. Problems. 10 Hours

UNIT –5:

Centrifugal pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems. 10 Hours

TEXT BOOKS:

1. An Introduction to Energy Conversion, Volume III, Turbomachinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2010.
2. Turbines, Compressors and Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd.,

REFERENCE BOOKS:

1. Principals of Turbomachines, D. G. Shepherd, The Macmillan Company .
2. Fluid Mechanics and Thermodynamics of Turbomachines, S. L. Dixon, Elsevier (2009).
3. Turbomachine, B.K.Venkanna PHI, 2010.

Course Code: **TOE 611 (OPEN ELECTIVE)** L T P C

Course Name: **NANO TECHNOLOGY** **3 0 0 3**

UNIT I:

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. 8Hour

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:

1. Introduction to Nanotechnology – C.P.Poole Jr F.J. Owens
2. Introduction to S.S. Physics - (7th Edn.) Wiley 1996.

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

Hour

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 Hour

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 Hour

TEXT BOOK :

1. Joseph, L. Massod, " Essential of Management", Prentice Hall of India.

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:

1. Mohamod Isiri, " Total Quality Management for Engineers".

REFERENCE BOOKS:

2. Juran, J., " Quality Planning and Analysis, Mc-Graw Hill.
3. James R. Evans,and J.W. Dean," Total Quality-management, Organisation and
4. Strategy," Thomson Asia Pvt. Ltd., Singapore.

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:

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1. Solar Energy, by S.P Sukhatme, Tata Mc Graw Hill.
2. Treatise on Solar Energy, by H.P Garg, john Wiley and Sons.

REFERENCE BOOKS:

1. Solar Energy: Thermal Processes, by Duffie John A, and Beckman W.A, johnWiley and Sons

Course Code: **PME-611** L T P C

Course Name: **REFRIGERATION AND AIRCONDITIONING LAB** **0 0 3 2**

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

1. Study of various elements of a mechanical refrigerator system through cut sections models of actual apparatus.
2. Study and performance of domestic refrigerator.
3. Study the performance of and Electrolux refrigerator.
4. Study of an Ice plant and visit to a cold storage plant for study.
5. Calculation/ Estimation of cooling load for large building.
6. Visit to a central Air conditioning plant for study of processes for winter and summer air conditioning.
7. Study of refrigeration system and determination of COP.
8. Study of window type air conditioning system.
9. Study of all weather year - round air conditioning system.
10. Study of LPG Refrigerator system.

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. Design of coupling –Rigid and flexible type.
2. Design of riveted joint.
3. Design of bolted joint.
4. Design of cotter and knuckle joint.
5. Design of leaf spring.
6. Design of screw Jack.
7. Design of IC engine parts, Piston, Connected rod, crankshaft, flywheel.
8. Design of gears.
9. Design and Selection of sliding and rolling element bearings.
10. Design of Brakes and Clutches.
11. Design of flat and V- belts, chains and wire ropes.
12. Best practices in computer aided design of some of above mention Design using 3D software.

Course Code: **PME-613** L T P C

Course Name: **FLUID MACHINERY LAB** **0 0 3 2**

Note: Students are required to perform all the experiments.

1. Performance testing of Turbines.
    a) Pelton wheel
    b) Francis Turbine
    c) Kaplan Turbines
2. Performance testing of Pumps.
    a) Single stage / Multi stage centrifugal pumps
    b) Reciprocating pump
3. Performance test of a two stage Reciprocating Air Compressor.
4. Performance test on an Air Blower.