PME3I101 MECHANICS OF SOLID

Theory L/T (Hours per week): 3/0, Credit: 3

MODULE - I (10 Lectures)

1. Concept of Stress:

Load, Stress, Principle of St.Venant, Principle of Superposition, Strain, Hooke's law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Strain energy in tension and compression, Resilience, Impact loads,

Analysis of Axially Loaded Members : Composite bars in tension and compression - temperature stresses in composite rods, Concept of Statically indeterminate problems.

Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson's ratio, Bulk Modulus, Relationship between elastic constants.

2. Biaxial State of Stress :

Analysis of Biaxial Stress.Plane stress, Principal plane, Principal stress, Mohr's Circle for Biaxial Stress. Stresses in thin cylinders and thin spherical shells under internal pressure, wire winding of thin cylinders.

MODULE - II (10 Lectures)

3. . Biaxial State of Strain:

Two dimensional state of strain, Principal strains, Mohr's circle for strain, Calculation of principal stresses from principal strains, Strain Rossette.

4. Shear Force and Bending Moment Diagrams:

Shear force and bending moment. Types of load and Types of support. Support reactions, Relationship between bending moment and shear force, Point of inflection. Shear Force and Bending Moment diagrams.

5. Bending of Beams:

Theory of simple bending of initially straight beams, Bending stresses, Shear stresses in bending, Distribution of normal and shear stress, Composite beams.

MODULE - III (8 Lectures)

6. Deflection of Beams :

Differential equation of the elastic line, Slope and deflection of beams by integration method and area - moment method.

7. Theory of Columns:

Long columns, Euler's column formula, Lateral buckling, Critical Load, Slenderness ratio, Eccentric loading of short column

MODULE - IV (8 Lectures)

8. Torsion:

Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Strength of shafts in combined bending and twisting, Close - Coiled helical springs.

TEXT BOOKS

1. Elements of Strength of Materials by S.P.Timoshenko and D.H.Young, Affiliated East West Press
2. Strength of Materials by G. H. Ryder, Macmillan Press
3. Strength of Materials by R.Subramaniam, Oxford University Press

REFERENCE BOOKS

1. Mechanics of Materials by Beer and Johnston, Tata McGraw Hill
2. Mechanics of Materials by R.C.Hibbeler, Pearson Education
3. Mechanics of Materials by William F.Riley, Leroy D.Sturges and Don H.Morris, Wiley
    a. Student Edition
4. Mechanics of Materials by James M. Gere, Thomson Learning
5. Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning
6. Strength of Materials by S.S.Rattan, Tata Mc Graw Hill
7. Engineering Machanics of Solids by Egor P. Popov, Prentice Hall of India

MECHANICS OF SOLID LABORATORY

Practical L/T/P (Hours per week): 0/0/2, Credit: 3

Laboratory Experiments (Minimum 8 experiments)

1. Determination of tensile strength of materials by Universal Testing Machine
2. Determination of compressive strength of materials by Universal Testing Machine
3. Determination of bending strength of materials by Universal Testing Machine
4. Double shear test in Universal Testing Machine
5. Determination of Impact strength of material (Charpy and Izod)
6. Determination of Hardness strength of materials (Brinnel, Rockwell and Vickers)
7. Determination of Rigidity modulus of material
8. Determination of Fatigue strength of material
9. Estimation of Spring Constant under Tension and Compression.
10. Load measurement using Load indicator, Load Cells.
11. Strain measurement using Strain Gauge.
12. Stress measurement using strain rosette.

PME3I001 INTRODUCTION TO PHYSICAL METALLURGY AND ENGINEERING MATERIALS

Theory L/T (Hours per week): 3/0, Credit: 3

MODULE-I (08 Lectures)

Classification of Engineering Materials, Engineering properties of materials. Characteristic property of metals, bonding in solids, primary bonds like ionic, covalent and metallic bond, crystal systems, common crystal structure of metals, representations of planes and directions in crystals, atomic packing in crystals, calculation of packing density, voids in common crystal structures and imperfections crystals.

MODULE-II (08 Lectures)

Concept of plastic deformation of metals, critical resolve shear stress, dislocation theory, deformation by slip and twin, plastic deformation in polycrystalline metals, yield point phenomenon and related effects, concept of cold working preferred orientation. Annealing ; recovery; recrystalization and grain growth; hot working.

Concept of alloy formation, types of alloys, solid solutions, factors governing solids solubility viz. size factor, valency factor, crystal structure factor and chemical affinity factor; order-disorder transformation.

MODULE-III (10 Lectures)

Binary phase diagrams (a) Isomorphism system, (b) Eutectic system, (c) Peritectic system, (d)Eutectoid system and (e) Peritectoid system. Allotropic transformation. Lever rule and its application, Interpretation of solidification behaviors and microstructure of different alloys belonging to those systems, Effect of non-equilibrium cooling, coring and homogenization.

Iron-cementite and iron-graphite phase diagrams, microstructure and properties of different alloys (alloy steels; stainless steel, tool steel, HSS, high strength low alloy steel) types of cast iron, their microstructures and typical uses. Specification of steel.

T.T.T. diagram: concept of heat treatment of steels i.e. annealing, normalizing, hardening and tempering; microstructural effects brought about by these processes and their influences on mechanical properties; factor affecting hardenability.

MODULE-IV (10 Lectures)

Optical properties of Materials: Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of optical properties. Lasers, Optical fibres- Principle, structure, application of optical fibres.

Plastic-: Thermosetting and thermoplastics.
Ceramics: Types, structure, Mechanical properties, application
Composite Materials: Agglomerated Materials: Cermets .Reinforced Materials: Reinforced Concrete. Fibre reinforced plastics, Properties of composites, Metal matrix composites, manufacturing procedure for fiber reinforced composite.

Text Books:

1. Introduction to Physical Metallurgy by Avner, Tata McGraw Hill
2. Materials Science and Engineering by W.D.Callister, Wiley and Sons Inc.
3. Physical Metallurgy: Principles and Practice by Ragahvan, PHI

Reference Books

1. Engineering Physical Metallurgy and Heat Treatment by Y.Lakhtin, Mir Publisher, Moscow.
2. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
3. Materials Science and Engineering by V.Raghavan, Prentice Hall of India Pvt.Ltd.
4. Elements of Materials Science & Engineering by Van Vlack, Pearson
5. Mechanical Metallurgy by Dieter, Tata MacGraw Hill
6. Composite Material science and Engineering by K. K. Chawla, Springer
7. Material Science and Metallurgy, by U. C. Jindal, Pearson

PME3I102 FLUID MECHANICS AND HYDRAULIC MACHINES

Theory L/T (Hours per week): 3/0, Credit: 3

Module I (12 Lectures)

Introduction: Scope of fluid mechanics and its development as a science

Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.

Fluid statics: Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer.

Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface.Buoyancy and floatation, Archimedes' principle, stability of immersed and floating bodies, determination of metacentric height.

Module II (14 Lectures)

Fluid kinematics: Introduction, description of fluid flow, classification of fluid flow. Reynold's number, Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity,

Mathematical definitions of irrotational and rotational motion. Circulation, potential function and stream function. Flow net

Fluid dynamics : Introduction,Introduction to N-S equation, Euler's equation along a streamline, energy equation, Bernoulli's equation and its application to siphon, venturimeter, orificemeter, pitot tube.

Flow in pipes and ducts: Loss due to friction, Minor energy losses in pipes Hydraulic Gradient Line (HGL), Total Energy Line (TEL), Power transmission in the fluid flow in pipes, fluid flow in pipes in series and parallel. Flow through nozzles.

Module III (8 Lectures)

Hydraulic turbines: Classification, Impulse and Reaction turbine; Tangential, Radial and axial turbine.

Impulse turbine, Pelton wheel, bucket dimensions, number of buckets in pelton wheel, efficiency and performance curves.

Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance curve. Function of draft tube and casing cavitation

Module IV (06 Lectures)
Centrifugal Pump: constructional features, vane shape, velocity triangles, Efficiencies, Multi stage centrifugal pumps, Pump Characteristic, NPSH and Cavitation.

Positive displacement pumps: Reciprocating Pump, Working principle, Discharge, work done and power requirement, Slip, Indicator diagram

Text Books

1. Fluid Mechanics, Y A Cengel, TMH
2. Fluid Mechanics and Hydraulic Machines, Modi & Seth
3. Fluid Mechanics, A.K. Mohanty, PHI
4. Fluid Mechanics and Machinery, Mohd. Kareem Khan, OXFORD

Reference Books:

1. Fluid Mechanics and Machinery, CSP Ojha and P.N. Chandramouli, Oxford University Press
2. Fluid Mechanics and Fluid Machines by A.K.Jain, Khanna Publishers
3. Introduction to Fluid Mechanics and Fluid Machines, S.K. Som and G. Biswas, TMH
4. Introduction to Fluid Mechanics, Fox, McDonald, Willey Publications
5. Fluid Mechanics by Kundu, Elsevier
6. An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge University Press
7. Engineering Fluid Mechanics by Garde et. al., Scitech
8. First course in Fluid Mechanics by Narasimhan, University press
9. Fluid Mechanics by J.F.Douglas, J.M.Gasiorek, J.A.Swaffield and L.B.Jack, Pearson Education
10. Fluid Mechanics and Machines, Sukumar Pati, TMH

Practical (Hours per week): 2, Credit: 1

Laboratory Exp[eriments (Minimum 8 experiments)

1. Determination of Metacentric Height and application to stability of floating bodies.
2. Determination of Cv and Cd of Orifices.
3. Experiments on impact of Jets
4. Experiments on performance of Pelton Turbine
5. Experiments on performance of Francis Turbine
6. Experiments on performance of Kaplan Turbine
7. Experiments on performance of centrifugal pump
8. Experiments on performance of reciprocating pump
9. Experiments on Reynold's Apparatus
10. 12 Experiments on Flow through pipes
11. Experiments on performance of Gear pump
12. Verifications of momentum equation

PME3I103 ENGINEERING THERMODYNAMICS

Theory L/T (Hours per week): 3/0, Credit: 3

Module-I (10 Lectures)

1. Review of First and Second laws:

First law analysis of unsteady flow control volumes, Entropy generation ,Entropy balance for closed systems and steady flow systems, Available energy, Quality of energy, Availability for non flow and flow process, Irreversibility, Exergy balance, Second law efficiency.

Module- II (12 Lectures)

2. Vapour Power Cycles:

The Carnot vapor cycle and its limitations, The Rankine cycle, Means of increasing the Rankine cycle efficiency, The reheat cycle, The regenerative feed heating cycle, Cogeneration (Back pressure and Pass-out turbines), Combined-cycle power generation systems, Binary vapour cycles.

3. Gas Power Cycles:

Air standard cycles- Otto, Diesel, Dual Combustion and Brayton cycles, The Brayton cycle with non-isentropic flow in compressors and turbines, The Brayton cycle with regeneration, reheating and intercooling, Ideal jet propulsion cycles.

Module- III (12 Lectures)

4. Refrigeration cycles:

Reversed Carnot cycle, Reversed Brayton cycle (Gas refrigeration system), The vapor compression cycle, The vapor absorption cycle.

5. General Thermodynamic property relations:

The Maxwell relations, The Clapeyron equation, The TdS relations, Isothermal compressibility and volume expansivity, The Joule-Thomson coefficient.

Module- IV (06 Lectures)

6. Reciprocating Air Compressors:

Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors.

Text Books

1. Engineering Thermodynamics by P. K. Nag, Publisher:TMH
2. Engineering Thermodynamics by P. Chattopadhyay, OXFORD
3. Fundamentals of Thermodynamics by Sonntag, Borgnakke, Van Wylen, John Wiley & Sons
4. Fundamentals of Engineering Thermodynamics by E. Rathakrishnan, PHI

Reference

1. Engineering Thermodynamics by M.Achyuthan, PHI
2. Engineering Thermodynamics by Y.V.C. Rao, University Press
3. Thermodynamics and Thermal Engineering by Kothandaraman & Domkundwar, Dhanpat Rai
4. Applied Thermodynamics by P.L.Ballaney, Khanna Publishers
5. Steam Tables in SI Units by Ramalingam, Scitech
6. Steam Tables by C.P.Kothandaraman, New Age International

Practical (Hours per week): 2, Credit: 1

Laboratory Experiments: (Minimum 8 experiments)

1. Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine.
2. Study of Cut-Sections of 2 stroke and 4 stroke Petrol Engine.
3. Study of steam power plant.
4. Study of refrigeration system.
5. Study of gas turbine power plant.
6. Performance analysis of reciprocating air-compressor.
7. Performance analysis of Centrifugal / Axial Flow compressor.
8. Determination of performance characteristics of gear pump.
9. Measurement of steam quality using calorimeter
10. Verification of Joule-Thomson coefficient.

PME3I104 KINEMATICS AND DYNAMICS OF MACHINES

Theory L/T (Hours per week): 3/1, Credit: 4

Module – I : (10 Lectures)

1. Kinematic fundamental: Basic Kinematic concepts and definitions, Degrees of freedom, Elementary Mechanism : Link, joint, Kinematic Pair, Classification of kinematic pairs, Kinematic chain and mechanism, Grüebler's criterion, Inversion of mechanism, Grashof criteria, Four bar linkage and their inversions, Single slider crank mechanism, Double slider crank mechanism and their inversion. Transmission angle and toggle position, Mechanical advantage.

2. Kinematic Analysis : Graphical analysis of position, velocity and acceleration of four bar and Slider crank mechanisms. Instantaneous centre method, Aronhold-Kennedy Theorem, Rubbing velocity at a Pin-joint.Coriolis component of acceleration.

Module – II : (10 Lectures)

3. Mechanism Synthesis : Graphical methods of synthesis, Chebychev spacing for precision positions, Freudenstein's equation applicable to four bar linkages.
4. Mechanism Trains: Gear Terminology and definitions, Analysis of mechanism Trains: Simple Train, Compound train, Reverted train, Epicyclic train and their applications.

Module – III : (8 Lectures)

5. **Combined Static and Inertia Force Analysis:** Inertia forces analysis**,** velocity and acceleration of slider crank mechanism by analytical method, engine force analysis - piston effort, force acting along the connecting rod, crank effort. dynamically equivalent system, compound pendulum, correction couple.

6. Friction Effects: Screw jack, friction between pivot and collars, single, multi-plate and cone clutches, anti friction bearing, film friction, friction circle, friction axis,

Module – IV : (8 Lectures)

7. Flexible Mechanical Elements: Belt, rope and chain drives, initial tension, effect of centrifugal tension on power transmission, maximum power transmission capacity, belt creep and slip.

8. Brakes &Dynamometers : Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, Braking of a vehicle. Absorption and transmission dynamometers, Prony brake, Rope brake dynamometer, belt transmission, epicyclic train, torsion dynamometer.

Text Books

1. Kinematics and Dynamics of Machinery by R L Norton, Tata MacGraw Hill
2. Theory of Machines and Mechanisms by John J. Uicker Jr., Gordon R. Pennock and Joseph E. Shigley, Oxford University Press
3. Theory of Machines by S.S.Rattan, Tata MacGraw Hill

Reference

1. Theory of Machines by Thomas Bevan, CBS Publications
2. Kinematics and Dynamics of Machinery by Charles E. Wilson and J.Peter Saddler, Pearson Education
3. Mechanism and Machine Theory by J.S.Rao and R.V.Dukipatti, New Age International.
4. Theory of Mechanisms and Machines by A. Ghosh & A. K. Mallick, East West Press.
5. Kinematics and Dynamics of Machines by G.H. Martin, McGraw-Hill.
6. Theory of Machines and Mechanisms by P.L.Ballaney, Khanna Publishers
7. Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, PHI.

Practical (Hours per week): 2, Credit: 1

Laboratory Experiments: (Minimum 8 experiments)

1. Design of any one working model related to Kinematics of Mechanisms i.e., Module I and II.
2. Design of any one working model related to Dynamics of Machinery i.e., Module III and IV.
3. Radius of gyration of compound pendulum
4. Radius of gyration of connecting rod
5. TRI –FILAR / BI-FILAR System
6. Experiment on Screw Jack
7. Experiment on Journal Bearing Apparatus
8. Experiment/Study on clutches
9. Experiment on Epicyclic Gear Train
10. Experiments on Simple/Compound/Reverted Gear trains
11. Experiment on Dynamometer
12. Experiment on Brake
13. Experiment on Coriolis component of acceleration

PEK3E001 ENGINEERING ECONOMICS

Theory L/T (Hours per week):2/1, Credit: 3

Module I (12 hours)

Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.

Demand- Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement (Simple numerical problems to be solved), Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).

Production-Production function, Laws of returns: Law of variable proportion, Law of returns to scale

Module II (12 hours)

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).

Banking -Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.

Inflation-Meaning of inflation, types, causes, measures to control inflation.

National Income-Definition, Concepts of national income, Method of measuring national income.

Module III (12 hours)

Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects .

Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method), After tax comparison of project.

Text Books

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
2. Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.
3. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
4. R.Paneer Seelvan, " Engineering Economics", PHI
5. Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd
6. Jhingan,M.L., "Macro Economic Theory"
7. Macro Economics by S.P.Gupta, TMH

POB3E002 ORGANIZATIONAL BEHAVIOUR

Credit- 3 Class Hours - 40

Objectives:

1. To develop an understanding of the behavior of individuals and groups inside organizations
2. To enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations.
3. To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes.

Unit	Contents	Class Hours
01	**Fundamentals of OB**: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behavioristic and social cognitive), Limitations of OB.	6
02	**Attitude:** Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes. **Personality and values:** Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality	10

model, Significant personality traits suitable to the workplace (personality and job – fit theory), Personality Tests and their practical applications.

Perception: Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect).
Motivation: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories – Equity Theory of Work Motivation.

03	**Foundations of Group Behavior:** The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five – Stage Model of Group Development. **Managing Teams:** Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building. **Leadership:** Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership, Success stories of today's Global and Indian leaders.	**9**
04	**Organizational Culture** : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.	**8**
05	**Organizational Change:** Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change. Implementing Organizational Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change & Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.	**7**

Reference Books

1. Understanding Organizational Behaviour, Parek, Oxford
2. Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.
3. Organizational Behaviour, K. Awathappa,HPH.
4. Organizational Behaviour, VSP Rao, Excel
5. Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.
6. Organizational Behaviour, Hitt, Miller, Colella, Wiley

HONOURS ELECTIVE

PME3D001 APPLIED MATHEMATICS (L/T: 4/0, Credit: 4)

Module-I (15 Hours)
Probability:
Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson, and Hyper-geometric distributions, Normal and exponential distribution, Distribution of several random variables.

Statistics:
Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Regression Analysis, Fitting Straight Lines, Correlation analysis

Module-II (15 Hours)
Partial Differential Equation:
Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge's method, Second order partial differential equation
The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates.

Module-III (08 Hours)
Complex Analysis:
Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,
Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

Module-IV (06 hours)
Power Series, Taylor's series, Laurent's series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:
1. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
2. B.V. Ramana, " Higher Engineering Mathematics", Tata McGraw Hill

Reference books:
1. E.B. Saff, A.D.Snider, " Fundamental of Complex Analysis", Third Edition, Pearson
2. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", Seventh Edition, Thomson/CENGAGE Learning India Pvt. Ltd
3. P. V.O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi
4. Mathematical Methods by Potter Goldberg Publisher: PHI

MINOR SPECIALIZATION

PME3G001 APPLIED THERMAL ENGINEERING

Theory L/T (Hours per week): 4/0, Credit: 4

Module-I (8 Lectures)

Review of First and Second laws:

First law analysis of unsteady flow control volumes, Entropy change for different process, Entropy generation ,Entropy balance for closed systems and steady flow systems, Available energy, Quality of energy, Availability for non flow and flow process, Irreversibility, Second law efficiency.

Module – II (8 Lectures)

Air Standard Cycle & Introduction to I.C. Engine: Otto, diesel and dual cycles, description and operation of four and two stroke cycle engine, comparison of SI and CI engines, valve timing diagram, power output and efficiency calculation. Brayton cycle, Gas turbine, Jet engines.

Reciprocating Air Compressors: Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors

Module – III (12 Lectures)

Steam and Steam Generator:- Properties of steam, measurement of dryness fraction, use of steam table and Mollier chart. T-S and H-S diagrams for representing thermodynamic processes. Boiler, Classification of boiler, comparison between water tube boiler and fire tube boiler. Boiler mountings and accessories. Description of Cochran & Babcock -Wilcox boiler.

Steam Nozzles:- Types of nozzles, isentropic flow through nozzles, effect of friction on nozzle efficiency. Critical pressure ratio and maximum discharge, throat and exit area.

Module – IV (14 Lectures)

Steam Turbines &Condensers:- Turbine type and applications. Impulse turbine, pressure and velocity compounding, velocity diagram, work output, losses and efficiency. Impulse reaction turbine, velocity diagram, degree of reaction, work output, losses and efficiency. Jet and surface condensers. Condenser vacuum and vacuum efficiency.

Heat Transfer: Basic modes of heat transfer, one dimensional steady state, conduction through slab, cylinder and sphere ; basic theory of radiant heat transfer, black body & mono chromatic radiation, total emissive power, heat exchangers.

Refrigeration system: Reversed Carnot cycle, Reversed Brayton cycle (Gas refrigeration system), The vapor compression cycle, The vapor absorption cycle, air conditioning.

Text Books

1. Engineering Thermodynamics by P. Chattopadhyay, OXFORD
2. Power plant Engineering by P. K. Nag, Publisher:TMH
3. Applied Thermodynamics by P.L.Ballaney, Khanna Publishers.