Fifth Semester								
	Theory					Practical		
Code	**Course Name**	**Hours/ week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ week L/T**	**Credit Practical**	**Marks**
PC	Design of Machine Elements	3-0	3	100	50	2	1	50
PC	Machining Science & Technology	3-0	3	100	50	2	1	50
PC	Heat Transfer	3-0	3	100	50	2	1	50
PE	Optimization in Engg./Project Management/Quality Management & Reliability	3-1	4	100	50			
OE	Energy Conversion Techniques/Human Resources Management/Marketing Management/ C++ & Object Oriented Programming/Internet & Web Technology/Analog & Digital Electronics/Digital Signal Processing	3-1	4	100	50			
PC	Advance Lab-I					8	4	200
Total		17	17	500	250	14	7	350
Total Marks: 1100								
Total Credits: 24								
Honours	Advanced Mechanics of Solids / Design of Machine Components/ Experimental Stress Analysis	4	4	100	50			
Minor	Manufacturing Process							

SEMESTER : 5TH

1.	PME5D001	HONOURS(O4)	ADVANCED MECHANICS OF SOLIDS	4-0-0	4
2.	PME5D002	HONOURS(O4)	DESIGN OF MACHINE COMPONENTS	4-0-0	4
3.	PME5D003	HONOURS(O4)	EXPERIMENTAL STRESS ANALYSIS	4-0-0	4
4.	PME5G001	MINOR(CP)	MANUFACTURING PROCESS	4-0-0	4
5.	PME5H001	OE(O2)	ENERGY CONVERSION TECHNIQUES	4-0-0	4
6.	PME5H002	OE(O2)	HUMAN RESOURCES MANAGEMENT	4-0-0	4
7.	PME5H003	OE(O2)	MARKETING MANAGEMENT	4-0-0	4
8.	PME5H004	OE(O2)	C++ & OBJECT ORIENTED PROGRAMMING	4-0-0	4
9.	PME5H005	OE(O2)	INTERNET & WEB TECHNOLOGY	4-0-0	4
10.	PME5H006	OE(O2)	ANALOG & DIGITAL ELECTRONICS	4-0-0	4
11.	PME5H007	OE(O2)	DIGITAL SIGNAL PROCESSING	4-0-0	4
12.	PME5I001	PC(CP)	DESIGN OF MACHINE ELEMENTS	3-0-0	3
13.	PME5I101	PC(CP)	MACHINING SCIENCE & TECHNOLOGY	3-0-1	4
14.	PME5I102	PC(CP)	HEAT TRANSFER	3-0-1	4
15.	PME5I201	PC(CP)	ADVANCE LAB - I	0-0-4	4
16.	PME5J101	PE(O3)	OPTIMIZATION IN ENGINEERING	4-0-1	4
17.	PME5J102	PE(O3)	PROJECT MANAGEMENT	4-0-1	4
18.	PME5J103	PE(O3)	QUALITY MANAGEMENT & RELIABILITY	4-0-1	4
					28

FIFTH SEMESTER

PME5I001 DESIGN OF MACHINE ELEMENTS

[Only specified data book as mentioned in the syllabus is permitted during examination]

MODULE-I (8 HOURS)

1. Mechanical engineering design: Introduction to design procedure, Stages in design, Code and Standardization, Interchangeability, Preferred numbers, Fits and Tolerances, Engineering materials: Ferrous, Non-ferrous, Non-metals, design requirements – properties of materials, Material selection, Use of Data books.

2. Fundamentals of Machine Design: Types of load, Modes of failure, factor of safety concepts, Theories of Failure, concept and mitigation of stress concentration, Fatigue failure and curve, endurance limit and factors affecting it, Notch sensitivity, Goodman, Gerber and Soderberg criteria.

MODULE-II (8 HOURS)

3. Machine Element Design: Design of Joints: Rivets, welds and threaded fasteners based on different types of loading, Boiler joints, cotter joints and knuckle joints.

MODULE-III (10 HOURS)

4. Design of Keys, Shaft and Couplings: Classification of keys and pins, Design of keys and pins, Theories of failure, Design of shafts: based on strength, torsional rigidity and fluctuating load, ASME code for shaft design, Design of couplings: Rigid coupling, Flexible coupling.

5. Design of Mechanical Springs: Types of helical springs, Design of Helical springs, bulking of spring, spring surge, end condition of springs, Design of leaf springs: nipping.

MODULE-IV (6 HOURS)

6. Bearings: Types and selection of ball and roller bearings, Dynamic and static load ratings, Bearing life, Design of sliding contact bearings, Journal bearing, foot step bearing.

TEXT BOOKS:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill
2. Mechanical Engineering Design, J.E.Shigley, C.R.Mischke, R.G.Budynas and K.J.Nisbett, TMH

REFERENCE BOOKS:

1. Machine Design, P.Kanaiah, Scietech Publications
2. Fundamentals of Machine Component Design by R.C.Juvinall and K.M.Marshek, John Wiley & Sons
3. Machine Drawing by N.Sidheswar, McGraw-Hill
4. Machine Design, P.C.Sharma and D.K.Agrawal, S.K.Kataria & Sons
5. Machine Design, Pandya and Shah, Charotar Book Stall
6. Machine Design, Robert L. Norton, Pearson Education Asia.
7. Design of Machine Elements by C. S. Sharma and K. Purohit, PHI

DESIGN DATA HAND BOOKS:

1. P.S.G. Design Data Hand Book, PSG College of Tech Coimbature
2. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
3. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications
4 .Design Data Hand Book by K.Mahadevan and B.Reddy,CBS Publishers

PRACTICAL (DESIGN OF MACHINE ELEMENTS)

1. Design of any one working model related to Design of machine elements i.e., Module I and II.
2. Design of any one working model related to Design of machine elements i.e., Module III and IV.

} Compulsory

3. Design & drawing of Riveted joint
4. Design and drawing of Cotter joint
5. Design and drawing of Knuckle joint
6. Design of shafts subjected to combined loading
7. Design and drawing of Flange coupling
8. Design of spring
9. Design of bearing

} Total no. of Drawing: 6
3 in drawing sheets
3 in AutoCad/Pro-E/ CATIA/ANSYS

Total number of Design : Minimum 8 nos including 2 working model.

PME5I101 MACHINING SCIENCE AND TECHNOLOGY

MODULE – I (13 HOURS)

Geometry of cutting tools in ASA and ORS, Effect of Geometrical parameters on cutting force and surface finish, Mechanics of chip formation, Merchant's theory, Force relationship and velocity relationship, Cutting tool materials, Types of Tool Wear: Flank wear, Crater wear, Wear measurement, Cutting fluid and its effect; Machinability Criteria, Tool life and Taylor's equation, Effect of variables on tool life and surface finish, Measurement of cutting force, Lathe tool dynamometer, Drill tool dynamometer. Economics of machining.

MODULE – II (13 HOURS)

Conventional machining process and machine tools – Turning, Drilling, Shaping, Planning, Milling, Grinding. Machine tools used for these processes, their specifications and various techniques used.

Principles of machine tools : Kinematics of machine tools, speed transmission from motor to spindle , speed reversal mechanism, mechanism for feed motion, Tool holding and job holding methods in different Machine tools, Types of surface generated, Indexing mechanism and thread cutting mechanism, Quick return mechanism,.

Production Machine tools – Capstan and turret lathes, single spindle and multi spindle semiautomatics, Gear shaper and Gear hobbing machines, Copying lathe and transfer machine

MODULE – III (10 HOURS)

Non-traditional Machining processes :

Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining, Electro Discharge Machining, Wire EDM , Abrasive Jet Machining

TEXT BOOKS :

1. Fundamentals of Machining and Machine Tools, G.Boothroyd and W.A.Knight, CRC Press
2. Metal Cutting Principles, M.C.Shaw, Oxford University Press
3. Metal Cutting Theory and Practice, A.Bhattacharya, Central Book Publishers

REFERENCE BOOKS :

1. Manufacturing Technology – by P.N.Rao, Tata McGraw Hill publication.
2. Modern Manufacturing Processes, P.C.Pandey, H.S.Shan, Tata McGraw Hill
3. Manufacturing Science, Ghosh and Mallik, East West Press.
4. Metal Cutting Theory and Practice, D.A.Stephenson and J.S.Agapiou, CRC Press
5. Machining Technology; Machine Tools and Operation, H.A.Youssef and H. El-Hofy, CRC Press
6. Machine Tools and Manufacturing Technology, Krar, Rapisarda and Check, Cengage Learning
7. Technology of Machine Tools, Krar, Gill and Smidt, Tata McGraw Hill
8. Principles of Metal Cutting, G.Kuppuswamy, Universities Press
9. Metal Cutting and Machne Tools, G.T.Reddy, Scitech
10. Fundamentals of tool Engineering Design, S.K.Basu, S.K.Mukherjee, R. Mishra , Oxford & IBH Pub Co.
11. Machine Tools, R.N.Datta, New Central Book Agency

PRACTICAL (MACHINING SCIENCE AND TECHNOLOGY LAB.)

(Minimum 08 Experiments/Studies)

LIST OF EXPERIMENTS:

1. Job on lathe with tapper turning, thread cutting, knurling and groove cutting (3 experiments).
2. Gear cutting (with index head) on milling machine
3. Working with shaper, Planner and slotting machine.
4. Working with surface and cylindrical grinding.
5. Determination of cutting force using Lathe tool dynamometer.
6. Determination of cutting force in drilling using drill tool dynamometer.
7. Study of Non-traditional machining processes.(USM, AJM, EDM, ECM)
8. Study of CNC Lathe and demonstration of making job in CNC lathe.
9. Study of CNC Milling machine and demonstration of making job in CNC Milling machine

PME5I102 HEAT TRANSFER

MODULE-I (12 HOURS)

1. **Introduction:**
   Modes of heat transfer: conduction, convection, and radiation ,Mechanism & basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity, Thermal conductance &Thermal resistance, Contact resistance, convective heat transfer coefficient, radiation heat transfer coefficient , Electrical analogy, combined modes of heat transfer.initial conditions *and* Boundary conditions of 1st, 2nd and 3rd Kind.
2. **Heat Conduction:**
   The General heat conduction in Cartesian, polar-cylindrical and polar-spherical co-ordinates, Simplification of the general equation for one and two dimensional steady/ transient conduction with constant/ variable thermal conductivity with / without heat generation. Solution of the one dimensional steady state heat conduction problem in case of plane walls, cylinders and spheres for simple and composite cases. Critical insulation thickness, Heat transfer in extended surfaces (pin fins) without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and fin effectiveness. Conduction in solids with negligible internal temperature gradient (Lumped heat analysis).

MODULE-II (12 HOURS)

3. **Convective Heat Transfer:**
   Introduction to convective flow - forced and free. Dimensional analysis of forced and free connective heat transfer. Application of dimensional analysis, physical significance of Grashoff , Reynolds, Prandtl, Nusselt and Stanton numbers.
   Conservation equations for mass, momentum and energy for 2-dimensional convective heat transfer in case of incompressible flow, Hydrodynamic and thermal boundary layers for flow over a flat plate. Critical Reynolds number; general expressions for drag coefficient and drag force Reynolds-Colbourn analogy. Thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer Coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow). Use of empirical relations for solving turbulent conditions for external and internal flow.
   Mechanism of heat transfer during natural convection, Experimental heat transfer correlations for natural convection in the following cases
   (a) Vertical and horizontal plates
   (b) Inside and outside flows in case of tubes

Module-III (8 hours)

4. **Radiative heat exchange :**
   Introduction, Radiation properties, definitions of various terms used in radiation heat transfer; Absorptivity,reflectivity & transmissivity.Emissive power & emissivity, Kirchoff's identity, Planck's relation for monochromatic emissive power of a black body, Derivation of Stefan-Boltzmann law and Wien's displacement law from Planck's relation, Radiation shape factor, Relation for shape factor and shape factor algebra. Heat exchange between black bodies through non-absorbing medium. Gray bodies and real bodies, Heat exchange between gray bodies. Radiosity and Irradiation, Electrical analogy and radiation network for 2-body and 3-body radiations exchange in non-absorbing medium, Radiation shields.

Module-IV (8 hours)

5. **Heat transfer for boiling liquids and condensing vapours :**
   Types of condensation, use of correlations for condensation on vertical flat surfaces, horizontal tube and; regimes of pool boiling, pool boiling correlations. Critical heat flux, concept of forced boiling. Numerical problems.
6. **Heat Exchangers :**
   Introduction, Types of heat exchanger, The overall heat transfer coefficient and fouling factors, LMTD and _ - NTU analysis of heat exchangers.

Text Books :

1. Heat Transfer Incropera and Dewitt, Willey publications
2. Heat Transfer : J.P.Holman, TMH Publications
3. Heat Transfer: P.S.Ghosdastidar, Oxford University Press
4. Fundamentals of Engineering Heat and Mass Transfer: R.C.Sachdeva, New Age International Publishers, 4th Edition

References :

1. Heat Transfer by P.K. Nag, TMH
2. Heat Transfer by S.P. Sukhatme, TMH
3. Heat Transfer: A.F.Mills and V.Ganesan, Pearson Education, 2nd Edition
4. Heat and Mass Transfer: Domkundwar and Arora, Danpatrai and sons
5. Heat Transfer : R.K.Rajput, Laxmi Publications
6. Heat and Mass Transfer: A Practical Approach, Y.A.Cengel, Tata Macgraw Hills Education Private Limited

PRACTICAL (HEAT TRANSFER LABORATORY)

1. Determination of Thermal conductivity of composite slab
2. Determination of heat transfer coefficient in natural/forced convention.
3. Determination of surface emissivity
4. Performance test on parallel flow and counter flow heat exchanger
5. Efficiency and effectiveness of fins (Natural / Forced convection)
6. Determination of Critical heat flux during boiling heat transfer.
7. Verification of Stefan Boltzman's law.

PME5J101 OPTIMIZATION IN ENGINEERING (PROFESSIONAL ELECTIVE)

MODULE-I (10 HOURS)

Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling. Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming .

MODULE -II (10 HOURS)

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method Assignment problems: Hungarian method for solution of Assignment problems Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

MODULE -III (10 HOURS)

Non-linear programming: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming Introduction to Genetic Algorithm.

TEXT BOOKS

1. A. Ravindran, D. T. Philips, J. Solberg, " Operations Research- Principle and Practice", Second edition, Wiley India Pvt Ltd
2. Kalyanmoy Deb, " Optimization for Engineering Design", PHI Learning Pvt Ltd
3. Prabhakar Pai, Operation Research, Oxford University Press

REFERENCE BOOKS:

1. Stephen G. Nash, A. Sofer, " Linear and Non-linear Programming", McGraw Hill
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis," Engineering Optimization", Second edition, Wiley India Pvt. Ltd
3. H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, "Operations Research", Eighth Edition, Pearson Education
4. F.S.Hiller, G.J.Lieberman, " Operations Research", Eighth Edition, TMH.
5. P.K.Gupta, D.S.Hira, "Operations Research", S.Chand and Company Ltd.

PME5J102 PROJECT MANAGEMENT (PROFESSIONAL ELECTIVE)

MODULE-I PROJECT MANAGEMENT CONCEPTS AND NEEDS IDENTIFICATION

Attributes of a Project, Project Life Cycle, The Project management Process, Benefits of Project Management, Needs Identification, Project Selection, Project organization, the project as part of the functional organization.

Project feasibility Analysis: Technical feasibility, commercial and financial visibility, Environment Analysis.

MODULE-II PROJECT PLANNING AND SCHEDULING:

Design of project management system; project work system; work breakdown structure,

project execution plan, work packaging plan, project procedure manual; project scheduling; bar charts, line of balance (LOB) and Network Techniques (PERT / CPM)/ GERT, Resource allocation, Crashing and Resource Sharing, capacity planning and expansion capacity decision.

MODULE III PROJECT MONITORING AND CONTROL AND PROJECT PERFORMANCE

Planning, Monitoring and Control; Design of monitoring system; Computerized PMIS (Project Management Information System). Coordination; Procedures, Meetings, Control; Scope/Progress control, Performance control, Schedule control, Cost control, Performance Indicators; Project Audit; Project Audit Life Cycle, Responsibilities of Evaluator/ Auditor, Responsibilities of the Project Manager.

BOOKS:

1. Project Planning, Analysis, Selection, Financing, Prasana Chandra, TMH
2. Project Management, Grey, TMH.
3. Project Management, Richman, PHI
4. Project Management, Vasant Desai, HPH
5. Project Management, Bhavesh M.Patel, Vikash
6. Project Engineering & Management- Prasanna Chandra, Prentice Hall.

PME5D002 DESIGN OF MACHINE COMPONENTS (HONOURS ELECTIVE)

MODULE I (8 HOURS)

1. **Design of Pressure vessels:** Thin pressure vessels: cylindrical and spherical vessels, Design of end Closures, Thick cylindrical shells.
2. **Design of Lever:** Classification, Design of levers, Cranked lever, Lever of safety - valve.

MODULE II (8 HOURS)

3. **Design of belt drive and power screw:** Design of belt drive and pulley, Power screw design with square thread such as screw jack.
4. **Design of clutch and brake**: Friction clutch, Cone clutch and Centrifugal clutch, Block brake, Band brake, Internal expanding shoe brake.

MODULE III (8 HOURS)

5. **Gears:** Design of Spur, Helical, bevel and worm gears.
6. **Flywheel:** Design of Flywheel.

MODULE IV (8 HOURS)

7. **Design of I.C. Engine components:** Design of Cylinder, Piston, Connecting Rod, Crank Shaft.
8. **Introduction to Finite Element Method:** FEM fundamental concepts, Procedure of FEM, Finite Element Modeling of one dimensional problems. Finite Element Analysis of 2-D problems: Shape function, Strain Displacement Relation, Element Characteristics Matrix.

TEXT BOOKS:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill
2. Design of Machine Elements by C. S. Sharma and K. Purohit, PHI

REFERENCE BOOKS:

1. Mechanical Engineering Design, J.E.Shigley, C.R.Mischke, R.G.Budynas and K.J.Nisbett, TMH
2. Machine Design, P.Kanaiah, Scietech Publications
3. Fundamentals of Machine Component Design by R.C.Juvinall and K.M.Marshek, John Wiley & Sons
4. Machine Drawing by N.Sidheswar, McGraw-Hill
5. Machine Design, P.C.Sharma and D.K.Agrawal, S.K.Kataria & Sons
6. Machine Design, Pandya and Shah, Charotar Book Stall
7. Machine Design, Robert L. Norton, Pearson Education Asia.

DESIGN DATA HAND BOOKS:

1. P.S.G. Design Data Hand Book, PSG College of Tech Coimbature
2. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
3. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications
4. Design Data Hand Book by K.Mahadevan and B.Reddy,CBS Publishers

PME5D001 ADVANCED MECHANICS OF SOLIDS
(Honours Elective)

MODULE – I (12 HOURS)

Elementary concept of elasticity, stresses in three dimensions, Principal Stresses, Stress Invariants, Mohr's Circle for 3-D state of stress, Octahedral Stresses, State of pure shear, Differential equations of equilibrium and compatibility conditions, plane stress. Analysis of strain, State of strain at a point, Strain Invariant, Principal Strains, Plane state of strain, Strain measurements. Theories of Failure, Various yield criteria

MODULE – II (14 HOURS)

Energy Methods: Work done by forces and elastic strain energy stored. Reciprocal relations, Theorem of virtual work, Castigliano's theorems, Bending of beams: Asymmetrical bending, Shear centre, Bending of curved beams, Stress distribution in beam with rectangular, circular and trapezoidal cross section, stresses in crane hooks, ring and chain links., Deflection of thick curved bars. Axisymmetric problems: Thick walled cylinder subjected to internal and external pressures, Compound cylinders, Shrink fit,

MODULE – III (10 HOURS)

Repeated stresses and fatigue in metals, Fatigue tests and fatigue design theory, Goodman, Gerber and Soderberg criteria, Concept of stress concentration, Notch sensitivity. Introduction to Mechanics of Composite Materials: Lamina and Laminates, Micromechanics of FRP Composites. Introduction to Fracture Mechanics: Basic modes of fracture, Fracture toughness evaluation.

TEXT BOOK:

1. Advanced Mechanics of Solids, L.S. Srinath, Tata McGraw Hill
2. Advanced Mechanics of Materials : Boresi and Schmdt, Willey

REFERENCE BOOK:

1. Advanced Mechanics of Materials : Siley and Smith
2. Strength of Materials Vol.II, by S.Timoshenko
3. Mechanical Metallurgy by Dieter
4. Strength of Materials by G. H. Ryder, Macmillan Press
5. Mechanics of Materials by Beer and Johnston, Tata McGraw Hill
6. Mechanics of Materials by R.C.Hibbeler, Pearson Education
7. Mechanics of Materials by William F.Riley, Leroy D.Sturges & Don H.Morris, Wiley Student.
8. Mechanics of Materials by James M. Gere, Thomson Learning
9. Engineering Machanics of Solids by Egor P. Popov, Prentice Hall of India
10. Strength of Materials by S.S.Rattan, Tata Mc Graw Hill

PME5D003 EXPERIMENTAL STRESS ANALYSIS
(Honours Elective)

MODULE – I (12 HOURS)

Elementary Elasticity : Stress at a point, Principal Stresses in 2D and 3D stress systems, strain and stressstrain velations, principal strains, plane stress and plane strain problems. Theory of Photo elasticity: Photo elasticity methods- Light and optics as related to photoelasticity, polarization of light, plane and circularly polarized light, plane polariscopes. The stress-optic law, effects of a stressed model in plane and civculor polariscopes. Dark field and light field arrangements.

MODULE – II (12 HOURS)

Photoelestic model materials for two-dimensional applications, calibration methods. Analysis techniques, Isochromatic and Isoclinic fringe Patterns, Compensation techniques, stress separation techniques, scaling model to prototype stresses. Birefringent coatings and scattered light in Photo-elasticity, reflection polariscope.

MODULE – III (14 HOURS)

Strain-measurement methods and related instrumentation Electrical resistance strain gauges, Gage construction, gage factor, selection, temperature compensation, semiconductor strain gauges. Strain gage circuits, Wheatstone and Potentiometer bridge circuits, Rosette Analysis, recording instruments, Dynamic strain measurements. Brittle coating methods, Behaviour of stress coats and its application. Grid Technique of displacement/strain analysis.

TEXT BOOKS:

1. Experimental Stress Analysis by James W. Dally and William F. Riley, Mc Graw Hill Pub. Co., 1965
2. Experimental stress Analysis and Motion Measurements by Dove and Adams Prentice Hall of India (P) Ltd.

REFERENCES :

1. Timoshenko, S. P. and Goodier, J.N., Theory of Elasticity, Mc Graw Hill Book Co., NY, 1951
2. Durelli, A.J., Phillips, E. and Tsao, C.H., Introduction to the Theoretical and Experimental Analysis of Stress and Strain, Mc Graw Hill Book Co., NY, 1958.
3. Frocht, M.M., Photoelasticity, John Wiley and Sons, Inc., NY, 1948. (vol I & II).
4. Durelli, A.J. Applied stress Analysis, Prentice Hall of India (P) Ltd.

PME5G001 MANUFACTURING PROCESSES (MINOR SPECIALIZATION)

MODULE – I (16 HOURS)

Definition and classification of manufacturing processes. Principle of casting, components of casting process including riser and gating system, pattern and types of pattern, pattern material, mould and moulding materials, properties, melting furnaces (copula), solidification of casting, casting methods and casting defects.

Introduction to gas welding, cutting, Arc welding and equipment's. TIG (GTAW) and MIG (GMAW) welding, resistance welding and Thermit welding(Basic Principles). Brazing and soldering, welding defects.

Plastic deformation of metals. Hot and cold working of metals, classification of metal forming processes. Rolling: types of rolling mills, Rolling defects. Forging: Smith Forging, Drop and Press forging, M/c forging (Basic Principles), Forging defects.

MODULE – II (14 HOURS)

Conventional machining process and machine tools – Turning, Drilling, Shaping, Planning, Milling, Grinding. Machine tools used for these processes, their specifications and various techniques used.

MODULE – III (14 HOURS)

Non-traditional Machining processes : Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining, Electro Discharge Machining, Wire EDM , Abrasive Jet Machining

Concept of Flexible manufacturing process, concurrent engineering, production tools like capstan and turret lathes, rapid prototyping processes.

TEXT BOOKS :

1. Manufacturing technology(Vol.I &II) by P.N.Rao, Tata McGraw Hill publication
2. Welding Technology by R.A. Little, TMH
3. A Text Book of Production Engineering (vol. I & II) by P.C.Sharma, S.Chand

REFERENCE BOOKS:

1. Modern Manufacturing Processes, P.C.Pandey, H.S.Shan, Tata McGraw Hill
2. Manufacturing Science, Ghosh and Mallik, East West Press.
3. Rapid Prototyping by Amitav Ghosh

ADVANCED LAB-I

PME5I201 MACHINE DRAWING

Orthographic and Sectional drawing of Machine components: (Any seven)
Screw threads, Screwed fastenings, Turn Buckle, Keys, Cotter joints and Knuckle joints; Pulley; Flanged coupling, Pedestal Bearing or Plummer Block.
Fundamentals of AutoCAD (Two classes)

1. Dimension & annotations
2. Use of Layers
3. Working with constraint in dimension
4. Creating assembly
5. Axi-symmetrical parts
6. Creating surface features
7. Working with bill of material

Drawing of the following using AUTOCAD: (Any two)

1. Projection of solids
2. Nut & bolt and Fasteners
3. Cotter joint
4. Expansion joint
5. Shaft coupling

TEXT BOOKS:

1. Machine Drawing by N.D.Bhatt, V.M.Panchal, Charotar Publishing House.
2. Machine Drawing by N.D.Junarkar, Pearson Education
3. Machine Drawing with AutoCAD by Goutam Pohit and Goutam Ghosh, Pearson
1. Education
4. Machine Drawing includes AutoCAD by Ajeet Singh, Tata MacGraw Hill

REFERENCE BOOKS:

1. Machine Drawing by K.L.Narayana, P.Kannaiah, K.Venkata Reddy, New Age International
2. Engineering Drawing and Graphics using AUTOCAD by T.Jayapoovan, Vikas Publishing

OTHER ELECTIVE

ENERGY CONVERSION TECHNIQUES (PME5H001)

MODULE- I (10 Hrs)

1. **DC GENERATORS**: Constructional features and operating principles, EMF equation, No Load Characteristics for Separately Excited DC Generator and DC Shunt Generator, Conditions for Self Excitation, Critical Resistance and Critical Speed, Losses and Efficiency.
2. **DC MOTORS**: Speed~Armature Current, Torque~Armature Current and Speed~Torque Characteristic for (i) Separately Excited DC Motor, (ii) DC Shunt Motor, (iii) DC Series Motor, Starting, Speed control and application of DC motor.

MODULE- II (10 Hrs)

3. **SINGLE PHASE TRANSFORMERS:** Constructional Features, EMF Equation, Turns Ratio, Open Circuit Test and Short Circuit Test, Losses and Efficiency, Introduction to Three Phase Transformers: Three Single Phase Transformers Connected as a Bank of Three Phase Transformer.
4. **INDUCTION MOTORS**: (a) Three Phase Induction Motors: Constructional Features of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Principle of Operation, Concept of Slip, Slip~Torque Characteristics, Starting of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Speed Control of Induction Motors. (b) Introduction to Single Phase Induction Motors: Construction, Principle of Operation and Application.

MODULE- III (10 Hrs)

5. **THREE PHASE SYNCHRONOUS GENERATORS**: Constructional Features, Principle of operation as Alternator, Synchronous reactance, Equivalent circuit of alternator, Power-Angle curve, Synchronization of alternators.
6. **THREE PHASE SYNCHRONOUS MOTORS**: Constructional Features, Principle of Operation, Torque Expression and Phasor Diagram for Synchronous Motor, Electrical Power and Mechanical Power, Starting and application of Synchronous Motor.

Text Book :

1. Electric Machines – D P Kothari & I J Nagrath – Tata McGraw Hill.

Reference Book(s):

2. The Performance and Design of DC Machines – A E Clayton.
3. Theory and Performance of AC Machines – M G Say
4. Electrical Machinery – P S Bimbhra – Khanna Publishers.
5. Electrical Machines – P K Mukherjee and S Chakravorti – Dhanpat Rai Publications.
6. Electric Machinery – Fitzgerald, Charles Kingsley Jr., S. D. Umans – Tata Mc Graw Hill.
7. Electric Machinery And Transformers – Guru &Hiziroglu – Oxford University Press. 8. Electric Machines – Charles Hubert – Pearson Education.

HUMAN RESOURCE MANAGEMENT (PME5H002)

Module I:

Concept scope and objectives of HRM. Relationship between HRM and HRD. The challenges for HRM – Environmental, organizational and Individual. Role and functions of HR managers in the changing business scenario. Human Resources Planning – overview, Recruitment – concept, objectives, legal framework regulating recruitment in India, Selection – Objectives and methods, Test and interviews, Induction and orientation, validity and reliability of Tests and interviews.

Module II:

Career Planning – concept, objectives. Different stages of career and its implications, Methods of career planning and development, Promotion – types and process, Transfer – types. Separations including lay off and retrenchment. Performance Management – concept and objectives. Performance Appraisal – concept objectives and methods – management by objectives (MBO), Assessment centre, 360 degree feedback. Appraisal errors. Competency mapping – concept, objectives and the process.

Module III:

Compensation Management – objectives and principles. wage & salary. Wage concept – minimum wage, Fair wage, living wage. nominal wage and real wage. Components of wages, methods of wage determination, job evaluation – methods wage differentials and its functions. Training and Development – Training need Assessment, Types of Training Programs – on the job and off the job training programs, Evaluation of effectiveness of training programs.

Books Recommended

1. Personnel & HRM – P. subha Rao, Himalaya Publishing House.
2. HRM - Text and cases – Aswathappa, THM
3. Managing Human Resources – Gomez, Belkin &Cardy, PHI. HRM – Snell, Bohlander, Vohra – Cengage Publication

MARKETING MANAGEMENT (PME5H002)

Objective of the Course: The course aims at introducing the basic concepts of marketing to the undergraduate students in engineering. The learning shall help the students in better designing, manufacturing and selling product/ service packages keeping competitive market, customers and cost in view.

Module – I (10 hours)

Marketing Management: Concept, Process, Functions and relevance in the current context. Marketing Environment: Elements of micro and macro environment Competition Analysis: Factors contributing to competition, porter's five forces model, Identifying and analyzing competitors. Marketing Planning : Exploring Opportunity, Product –market selection, Marketing Planning Process. Market Research and Information Systems: Research Process, The Internet and World Wide Web based Information collection and processing, Database, Data Warehouses and Data Mining, Global Market Research. Consumer Behavior: Factors influencing consumer behavior, consumer decision process. Organizational buying behavior.

Module II (10 hours)

Market Segmentation, Targeting and Positioning: Definition, Bases of segmenting consumer and Industrial markets. Target Market strategies: Market Positioning. Market Demand Forecasting: Key Terms, Forecasting Tools: Short term tools: Moving average and Exponential smoothing methods, Long-term forecasting Tools: Time series analysis, Econometrics methods, Qualitative tools : Buying Intention Survey, Sales Force Opinion and Delphi Techniques. Product Planning : Product Life Cycle, New Product Development Process, Branding Strategy, Positioning a Brand, Brand Equity, Packaging and Labeling, Product-mix and Product Line, Planned Obsolescence.

Module – III (10 hours)

Pricing Decision: Objectives and Factors influencing pricing, Pricing method and strategies. Integrated Marketing Communication(IMC)- Concept of IMC, the marketing communication process, Promotion Mix, elements of promotion mix, Direct marketing. Channels of Distributions: Types of intermediaries, functions of distribution channels, channel levels, Designing Distribution Channels, Physical Distribution, Supply Chain Management (Basic only). Trends in Marketing: Green Marketing, Customer Relationship Management, Emarketing, Rural Marketing and Service Marketing (concepts only)

Text Book:

1. Etzel , Walker ,Stanton and Pandit, Marketing, 14/e, Tata McGraw Hill.
2. Saxena, "Marketing Management" Tata McGraw Hill, 4/e.

Reference

1. Grewal, Levy, 'Marketing' Tata McGraw Hill, special Indian edition.
2. Karunakaran "Marketing Management", Himalaya Publishing House, 2010/e.
3. Kotler, Keller,Koshy and Jha, "Marketing Management", 13/e, Pearson Education.

C++ AND OBJECT ORIENTED PROGRAMMING (PME5H004)

Module I(08 hrs)
Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II(16 hrs)
Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references. Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors. Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes. Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators. Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III(08 hrs)
Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor. Template: template classes, template functions. Namespaces: user defined namespaces, namespaces provided by library.

Text Books:
1. Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

Reference Books:
1. Big C++ - Wiley India
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
3. "C++ and Object Oriented Programming" – Jana, PHI Learning.
4. "Object Oriented Programming with C++ "- Rajiv Sahay, Oxford
5. Mastering C++ - Venugopal, McGraw-Hill Education (India) "Object Oriented Programming with C++", David Parsons, Cengage Learning.

INTERNET AND WEB TECHNOLOGY (PME5H005)

Module –I (Lecture Hour 12)

The Internet and WWW

Understanding the WWW and the Internet, Emergence of Web, Web Servers, Web Browsers, Protocols, Building Web Sites

HTML

Planning for designing Web pages, Model and structure for a Website, Developing Websites, Basic HTML using images links, Lists, Tables and Forms, Frames for designing a good interactive website

Module –II (Lecture Hour 12)

JAVA Script

Programming Fundamentals, Statements, Expressions, Operators, Popup Boxes, Control Statements, Try…. Catch Statement, Throw Statement, Objects of Javascript: Date object, array object, Boolean object, math object

CSS

External Style Sheets, Internal Style Sheets, Inline Style, The class selector, div & span tag

DOM

HTML DOM, inner HTML, Dynamic HTML (DHTML), DHTML form, XML DOM

Module –III (Lecture Hour 11)

CGI/PERL

Introduction to CGI, Testing & Debugging Perl CGI Script, Using Scalar variables and operators in Perl

Java Applet

Introduction to Java, Writing Java Applets, Life cycle of applet

Textbooks

1. Web Warrior Guide to Web Design Technologies, Don Gosselin, Joel Sklar& others, Cengage Learning

Reference Books

1. Web Programming: Building Internet Applications, Chris Bates, Wiley Dreamtech
2. Programming the World Wide Web, Robert W Sebesta, Pearson
3. Web Technologies, Uttam K Roy, Oxford
4. Web Technology: A developer perspective, Gopalan&Akilandeswari, PHI

ANALOG AND DIGITAL ELECTRONICS (PME5H006) (OE)

MODULE – I (9 Hours)

1. **Diode Circuits:**Zener Diode Voltage Regulator, Diode Circuits with Time-Varying Sources, Switching Characteristics of a Diode, Special Purpose Diodes ,Rectifiers and Filters. (4 Hours)

2. **Small Signal Amplifier:** Transistor Hybrid Model, Transistor Biasing, Bias Design, AC Gain, Input and Output Impedances, Some Special Circuits, Darlington Pairs and Feedback Pairs, Frequency Response of Single Stage RC Coupled Amplifiers and Multistage Transistor Amplifiers. (5 Hours)

MODULE – II (12 Hours)

3. **Large Signal Amplifiers:** Classification, Class-A and Class-B Power Amplifiers Complimentary and Symmetry Amplifiers, Class-C Amplifiers. . (4 Hours)

4. **Feed Back Amplifiers and Oscillators:** Feedback Concepts, Types of Feedback Circuits, Effects of Negative Feedback Circuits, Unijunction Oscillator and PLL. (4 Hours)

5. **Operational Amplifier:** Basic Operational Amplifier, Differential Amplifier, Basic Operational Amplifier Circuits, Application of OPAMPs, Linear Application of OPAMPs, OPAMP Filters. (4 Hours) MODULE – III (13 Hours)

6. **Conditional Circuits:** Introduction to Digital Electronics Circuits, K-maps and their Simplification, Adder, Subtractors, Digital Comparator Circuits, Parity Checkers/Generators, Multiplexers and Decoders, Demultiplexers/Decoders, Programmable Logic Arrays. (5 Hours)

7. **Sequential Circuits and Systems:** Introduction, Memory Cells and Flip-Flops, Resistors, Counters, Asynchronous Counters, State Diagrams, Memories, ROM and RAM, Digital to Analog and Analog to Digital Converters (DAC and ADC). (5 Hours)

8. **Multivibrators and Switching Regulators:**Multivibrators, Analog Multivibrators, 555 Timer, Power Supply and Regulators (3 Hours)

Text Books:

1. Electronics: Analog and Digital, I.J. Nagrath (Selected portions of Chapter 1, 3, 4, 5, 6, 7, 9, 10, 11), PHI Learning Pvt. Ltd., New Delhi.

Reference Books:

1. Millman's Electronic Devices and Circuits, 2nd Edition, J. Millman, C. Halkias, and S. Jit, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. Electronic Devices and Circuit Theory, 9th/10th Edition, R.L. Boylestad and L. Nashelsky, Pearson Education, New Delhi.
3. Digital Fundamentals, 5th Edition, T.L. Floyd and R.P. Jain, Pearson Education, New Delhi.
4. Fundamentals of Digital Circuits, 2nd Edition, A. Anand Kumar, PHI Learning Pvt. Ltd., New Delhi.

DIGITAL SIGNAL PROCESSING (PME5H007)

Module – I (10 hours)

The Z-Transform and Its Application to the Analysis of LTI Systems:

The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain: Response of Systems with rational System Functions, Transient and Steady-State Responses, Causality and Stability, Pole-Zero Cancellations. Selected portions from Chapter 3 (3.1.1, 3.1.2, 3.2, 3.4.2, 3.4.3, 3.5.1, 3.5.2, 3.5.3, 3.5.4) of Textbook – I

The Discrete Fourier Transform: Its Properties and Applications

Frequency Domain Sampling: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT; The Discrete Cosine Transform: Forward DCT, Inverse DCT, DCT as an Orthogonal Transform. Chapter – 7 of Textbook – 1.

Module – II (10 hours)

Implementation of Discrete-Time Systems:

Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures. Selected portions from Chapter 9 (9.1, 9.2.1, 9.2.2, 9.2.3, 9.3.1, 9.3.2, 9.3.3, 9.3.4) of Textbook – I

Design of Digital Filters:

General Considerations: Causality and Its Implications, Characteristics of Practical Frequency-Selective Filters; Design of FIR Filters: Symmetric and Antisymmetric FIR
Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation. Selected portions from Chapter 10 (10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.2.4, 10.3.2, 10.3.3) of Textbook – I

Module- III (15 hours)

Efficient Computation of the DFT: Fast Fourier Transform Algorithms

Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation. Selected portions from Chapter 8 (8.1.1, 8.1.3, 8.2.1, 8.2.2, 8.2.3) of Textbook – I

Adaptive Filters:
Application of Adaptive Filters: System Identification or System Modeling, Adaptive Channel Equalization, Adaptive Line Enhancer, Adaptive Noise Cancelling; Adaptive Direct-Form FIR Filters-The LMS Algorithm: Minimum Mean Square Error Criterion, The LMS Algorithm. Selected portions from chapter 13 (13.1.1, 13.1.2, 13.1.5, 13.1.6, 13.2.1, 13.2.2) of Text book –I

Text Books
1. Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.

Reference Book :
1. Digital Signal Processing: a Computer-Based Approach – Sanjit K. Mitra, TMH.
2. Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH.
3. Digital Signal Processing – Manson H. Hayes (Schaum's Outlines) Adapted by Subrata Bhattacharya, Tata McGraw Hill.
4. Digital Signal Processing: A Modern Introduction – Ashok Ambardar, Cengage Learning.
5. Modern Digital Signal Processing – Roberto Cristi, Cengage Learning.
6. Digital Signal Processing: Fundamentals and Applications – Li Tan, Academic Press, Elsevier.
7. Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, Cengage Learning.
8. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, Cengage Learning.

QUALITY MANAGEMENT AND RELIABILITY (PME5J103)

Module- I (8 hours)

Attributes of quality, Evolution of philosophy of Quality Management: Inspection, Quality Control, Quality Assurance, Total Quality Management, Cost of quality

Acceptance sampling: Design of single sampling plan. Double, multiple and sequential sampling plans, O.C. curve, Producer's risk and consumer's risk, AOQ, AOQL

Module-II (10 hours)

Statistical process control, Use of control charts and process engineering techniques for implementing quality plan, X-Chart, R-Chart, p-chart, np-chart, c-chart, cusum-chart, Process capability analysis, statistical tolerance analysis

Experimental designs and factorial experiments: 2^k factorial experiments, Taguchi philosophy; Loss function; Signal to noise ratio, Orthogonal arrays for parameter and tolerance design.

Module-III (6 hours)

Definition – Reliability vs quality; Reliability function – MTBF, MTTR, availability; Bathtubcurve – time dependent failure models – distributions – normal, weibull; Reliability of system and models – serial, parallel and combined configuration; Economic analysis and life cycle cost; Proactive, preventive, predictive maintenance; Maintainability and availability

Module-IV (8 hours)

Quality Improvement: Fundamentals of TQM; Some important philosophies and their impact on quality (Deming, Juran, Crossby); Quality circle, QC Tools;Service Quality; Quality Standard: Product and Process Standard, Introduction to ISO 9000 and 14000 standards; Concept of Six Sigma, Lean Management and TPM

Books

1. Quality Planning and Analysis, Juran J M and Gryna F M, TMH
2. Statistical Process Control and Improvement, A. Mitra, Pearson.
3. Introduction to Statistical Quality control, D.C. Montgonery, John Wiley & sons.
4. Introduction to /reliability and MaitainabilityEngg E. Ebeling, MC-Graw Hill.
5. Quality control and Application ,B.L. Hansen and P.M. Ghare, Prentice Hall of India.
6. Statistical Quality Control, M. Mahajan, Dhanpat Rai & Sons.
7. K C Jain and A K Chitale, Quality Assurance and Total Quality Management, Khanna Publishers
8. K.S. Krishnamoorthi& V. Ram Krishnamoorthi, "A First Course in Quality Engineering" CRC Press

Sixth Semester								
	Theory					Practical		
Code	**Course Name**	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
PC	Production & Operation Management	3-0	3	100	50	2	1	50
PC	Refrigeration & Air Conditioning	3-0	3	100	50	2	1	50
PE	Product Design & Production Tooling/Computer Integrated Manufacturing & FMS/CAD & CAM	3-1	4	100	50			
PE	Compressive Flow & Gas Dynamics/Automobile Engineering/ Non-Conventional Energy Sources	3-1	4	100	50			
MC & GS	Environmental Science & Engineering	3-0	3	100	50			
OE	Industrial Lecture #					3	1	50
HS	Business communication & Skill for Interview # #	2-0	1		50	4	2	100
MC	Yoga					2	1	50
Total		19	18	500	300	13	6	300
Total Marks: 1100								
Total Credits: 24								
Honours	Advanced Fluid Mechanics/ Fluid Power and Turbo Machinery/ Power Plant Engineering	4	4	100	50			
Minor	Mechanics of Solid							

SEMESTER : 6TH

1.	PME6D001	HONOURS(O3)	ADVANCED FLUID MECHANICS	4-0-0	4
2.	PME6D002	HONOURS(O3)	FLUID POWER AND TURBO MACHINERY	4-0-0	4
3.	PME6D003	HONOURS(O3)	POWER PLANT ENGINEERING	4-0-0	4
4.	PME6E101	HS(CP)	BUSINESS COMMUNICATION & SKILL FOR INTERVIEW	1-0-2	3
5.	PME6G001	MINOR(CP)	MECHANICS OF SOLID	4-0-0	4
6.	PME6H301	OE(CP)	INDUSTRIAL LECTURE #	0-0-1	1
7.	PME6I101	PC(CP)	PRODUCTION & OPERATION MANAGEMENT	3-0-1	4
8.	PME6I102	PC(CP)	REFRIGERATION & AIR CONDITIONING	3-0-1	4
9.	PME6J001	PE(O1)	PRODUCT DESIGN & PRODUCTION TOOLING	4-0-0	4
10.	PME6J002	PE(O1)	COMPUTER INTEGRATED MANUFACTURING & FMS	4-0-0	4
11.	PME6J003	PE(O1)	CAD / CAM	4-0-0	4
12.	PME6J004	PE(O2)	COMPRESSIVE FLOW & GAS DYNAMICS	4-0-0	4
13.	PME6J005	PE(O2)	AUTOMOBILE ENGINEERING	4-0-0	4
14.	PME6J006	PE(O2)	NON-CONVENTIONAL ENERGY SOURCES	4-0-0	4
					28

PME6I101 PRODUCTION AND OPERATION MANAGEMENT

Objective : The course aims at acquainting all engineering graduates irrespective of their specializations the basic issues and tools of managing production and operations functions of an organization.

MODULE I

1. Operations Function in an Organization, Manufacturing Vrs Service Operations, System view of Operations, Strategic Role of Operations, Operations Strategies for Competitive Advantage, Operations Quality and Productivity Focus, Meeting Global Challenges of Production and Operations Imperatives. **(3 Hours)**
2. Designing Products, Services and Processes: New Product Design- Product Life Cycle, Product Development Process, Process Technology : Project, Jobshop, Batch, Assembly Line, Continuous Manufacturing; Process Technology Life Cycle, Process Technology Trends, FMS, CIM, CAD, CAM; Design for Services, Services Process Technology. **(4 Hours)**
3. Work Study: Methods Study- Techniques of Analysis, recording, improvement and standardization; Work Measurement : Work Measurement Principles using Stopwatch Time Study, Predetermined Motion Time Standards and Work Sampling, Standard Time Estimation. **(4 Hours)**

MODULE II

4. Location and Layout Planning : Factor Influencing Plant and Warehouse Locations, Impact of Location on cost and revenues. Facility Location Procedure and Models : Qualitative Models, Breakeven Analysis, location Model, centroid method.
   Layout Planning: Layout Types : Process Layout, Product Layout, Fixed Position Layout Planning, block diagramming, line balancing, computerized layout planning- overview.
   Group Technology **(4 Hours)**
5. Forecasting : Principles and Method, Moving Average, weighted Moving Average, Exponential Smoothing, Winter's Method for Seasonal Demand, Forecasting Error.**(4 Hours)**
6. Manufacturing Planning and Control : The Framework and Components : Aggregate Planning, Master Production Scheduling, Rough-cut-Capacity Planning, Material Requirements Planning, Capacity Requirements Planning. **(5 Hours)**

MODULE III

7. Sequencing and Scheduling : Single Machine Sequencing : Basics and Performance Evaluation Criteria, Methods for Minimizing Mean Flow Time, Parallel Machines : Minimization of Makespan, Flowshop sequencing : 2 and 3 machines cases : Johnson's Rule and Jobshop Scheduling : Priority dispatching Rules. **(3 Hours)**
8. Inventory Control : Relevant Costs, Basic EOQ Model, Model with Quantity discount, Economic Batch Quantity, Periodic and Continuous Review Systems, Safety Stock, Reorder Point and Order Quantity Calculations. ABC Analysis. **(4 Hours)**
9. Modern Trends in Manufacturing : Just in Time (JIT) System : Shop Floor Control By Kanbans, Total Quality Management, Total Productive Maintenance, ISO 9000, Quality Circle, Kaizen, Poka Yoke, Supply Chain Management. **(4 Hours)**

REFERENCE BOOK:

1. S.N.Chary, "Production and Operations Management", Tata McGraw Hill.
2. R. Paneerselvam, "Production and Operations Management, Prentice Hall of India.
3. Aswathappa & Bhatt – Production & Operations Management, HPH.
4. Gaither & Frazier - Operations Management, Cengage Publication
5. Russell & Taylor - Operations Management, PHI Publication
6. Chase, Aquilanno, Jacob & Agarwal - Operations Management, TMH Publication.
7. E.E. Adam and R.J. Ebert "Production and Operations Management", Prentice Hall of India

Production and Operation Management Practical

1. Do Work Sampling of any work situation and determine how much time is spent in value addition, inspection /checking, communication and idleness.

2. Collect layout of any industry/ institute and design layout of similar industry/ institute to be constructed on a different site.

3. Select two or more possible locations for setting up of an industry/ institute and do comparative evaluation with respect to different parameters.

4. Gather sample data about stock of different items, their consumption pattern and price from any one of the following business firms such as Automobile Repair Shop, Medicine Store, Consumer Store, Production Shop, Service Centre etc and suggest stock that should be maintained for optimizing Inventory.

5. Hands on practice on any Manufacturing Execution System (MES) software/ ERP suit such as NetSuite Manufacturing, IQMS MES Software, Fishbowl Manufacturing, JobBOSS, MES SIMATIC IT, etc.

6. Hands on practice on simulation software for manufacturing/ supply chain/ logistics, such as Arena, Witness, Flexsim, Plant Simulation, AnyLogic, Simio, etc.

***Students may do 2 to 3 activities individually or in group**

PME6I102 REFRIGERATION AND AIR CONDITIONING

MODULE I (12 HOURS)

1. Air Refrigeration System : Introduction, Unit of refrigeration, Coefficient of performance, Reversed Carnot Cycle, Temperature limitations, maximum COP, Bell Coleman air cycle, Simple Air Cycle System for Air-craft with problems.

2. Vapour Compression System : Analysis of theoretical vapour compression cycle, Representation of cycle on T - S and p - h diagram, Simple saturation cycle, sub-cooled cycle and super-heated cycle, Effect of suction and discharge pressure on performance, Actual vapour compression cycle. Problem illustration and solution.
3. Multi-stage compression and Multi-evaporator systems : Different arrangements of compressors and inter-cooling, Multistage compression with inter-cooling, Multi-evaporator system, Dual compression system. Simple problems

MODULE II (12 HOURS)

4. Vapour Absorption System : Simple Ammonia - absorption system, Improved absorption system, Analysis of vapour absorption system (Specifically of analyzing coloumn and rectifier), Electrolux / Three fluid system, Lithium-bromide-water vapour absorption system, comparison of absorption system with vapour compression system. Simple Problems and solution.
5. Thermoelectric Refrigeration: Basics and Principle. Defining the figure of Merit. (No Problem)
6. Refrigerants ; Classification of refrigerants and its degignation- Halocarbon (compounds, Hydrocarbons, Inorganic compounds, Azeotropes, Properties of refrigerants, comparison of common refrigerants, uses of important refrigerants, Brines. Alternative refrigerants (Organic and inorganic compounds).

MODULE III (10 HOURS)

7. Psychrometrics : Properties of air-vapour mixture, Law of water vapour-air mixture, Enthalpy of moisture, Psychrometric chart, simple heating and cooling, Humidification, De-humidification, Mixture of air streams. Review question and discussions
   Requirements of comfort air conditioning: Oxygen supply, Heat removal, moisture removal, air motion, purity of air, Thermodynamics of human body, comfort and comfort chart, effective temperature, factors governing optimum effective temperature

MODULE IV (06 HOURS)

8. Air Conditioning System: Process in air conditioning : Summer air conditioning, Winter air conditioning and year round air conditioning, Cooling load calculations. Review question and discussions.

TEXT BOOKS :

1. Refrigeration and Air Conditioning by R.C. Arora , PHI Publication
2. Refrigeration and Air conditioning by C.P. Arora, Tata McGraw Hill.
3. 2Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpat Rai & Sons. Chapters ; 3,4,5,6,7,11,16,17,19,20
4. Refrigeration and Airconditioning Data book by Manohar Prasad

REFERENCE BOOKS :

1. Refrigeration and Air conditioning by P.L. Ballney, Khanna Publishers.
2. Refrigeration and Air conditioning by Manohar Prasad,New Age international publishers.

PRACTICAL (REFRIGERATION & AIR CONDITIONING LAB)

1. Determination of C.O. P on vapour compression system

2. Determination of C.O. P on vapour absorption system

3. Performance test on Air conditioning test rig (Window type)

4. Performance test on Air conditioning test rig (Duct type)

5. Determination of C.O.P of ice plant

6. Determination of C.O.P of Heat Pump

7. Performance analysis in an experimental cooling tower.

PROFESSIONAL ELECTIVES

PME6J001 PRODUCT DESIGN AND PRODUCTION TOOLING

MODULE – I (14 HOURS)

Product Design-Product design considerations, product planning, product development, value analysis, product specification. Role of computer in product design.

Process Planning – selection of processes, machines and tools. Design of sequence of operations, Time & cost estimation

MODULE – II (14 HOURS)

Forging design- allowances, die design for drop forging, design of flash and gutter, upset forging die design.

Sheet metal working- Design consideration for shearing, blanking piercing, deep drawing operation, Die design for sheet metal operations, progressive and compound die, strippers , stops, strip layout.

MODULE – III (16 HOURS)

Design of jigs and fixtures, principle of location and clamping, clamping methods, locating methods, Drill Jig bushing, Indexing type drilling Jig.

Design of single point cutting tool, broach and form tool. Tooling design for turret lathe and automats. Design of limit gauges.

TEXT BOOKS :

1. Product Design & Manufacturing, A K Chitale, R C Gupta, Eastern Economy Edition, PHI.
2. Product Design & Development, Karl T Ulrich, Steven D Eppinger, Anita Goyal, Mc Graw Hill.
3. A Textbook of Production Engineering, P.C. Sharma, S. Chand & Co

REFERENCE BOOKS:

1. Fundamentals of Tool Engineering design, S.K. Basu, S.N. Mukherjee, R. Mishra, Oxford & IBH Publishing co.
2. Technology of Machine Tools, Krar, Gill, Smid, Tata Mc Graw Hill
3. Jigs & Fixture Design, Edwrd G Hoffman, Cengae Learning.

PME6J002 COMPUTER INTEGRATED MANUFACTURING & FMS

(PROFESSIONAL ELECTIVE)

MODULE – I (14 HOURS)

Fundamentals of Manufacturing and Automation: Production systems, automation principles and its strategies; Manufacturing industries; Types of production function in manufacturing; Automation principles and strategies, elements of automated system, automation functions and level of automation; product/production relationship, Production concept and mathematical models for production rate, capacity, utilization and availability; Cost-benefit analysis.

Computer Integrated Manufacturing: Basics of product design, CAD/CAM, Concurrent engineering, CAPP and CIM.

MODULE – II (14 HOURS)

Industrial Robotics: Robot anatomy, control systems, end effectors, sensors and actuators; fundamentals of NC technology, CNC, DNC, NC part programming; Robotic programming, Robotic languages, work cell control, Robot cleft design, types of robot application, Processing operations, Programmable Logic controllers: Parts of PLC, Operation and application of PLC, Fundamentals of Net workings; Material Handling and automated storage and retrieval systems, automatic data capture, identification methods, bar code and other technologies.

MODULE – III (16 HOURS)

Introduction to manufacturing systems: Group Technology and cellular manufacturing, Part families, Part classification and coding, Production flow analysis, Machine cell design, Applications and Benefits of Group Technology.

Flexible Manufacturing system: Basics of FMS, components of FMS, FMS planning and implementation, flexibility, quantitative analysis of flexibility, application and benefits of FMS.

Computer Aided Quality Control: objectives of CAQC, QC and CIM, CMM and Flexible Inspection systems.

TEXT BOOKS :

1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover, Pearson Publication.
2. Automation, Production systems & Computer Integrated Manufacturing, M.P Groover, PHI.
3. CAD/CAM/CIM, P.Radhakrishnan, S.Subramanyam and V.Raju, New Age International
4. Flexible Manufacturing Systems in Practice, J Talavage and R.G. Hannam, Marcell Decker

REFERENCE BOOKS:

1. CAD/CAM Theory and Practice, Zeid and Subramanian, TMH Publication
2. CAD/CAM Theory and Concepts, K. Sareen and C. Grewal, S Chand publication
3. Computer Aided Design and Manufacturing, L. Narayan, M. Rao and S. Sarkar, PHI.
4. Principles of Computer Integrated Manufacturing, S.K.Vajpayee, PHI
5. Computer Integrated Manufacturing, J.A.Rehg and H.W.Kraebber, Prentice Hall

PME6J003 COMPUTER AIDED DESIGN AND COMPTER AIDED MANUFACTURING (CAD&CAM)

(PROFESSIONAL ELECTIVE)

MODULE – I (14 HOURS)

Fundamentals of CAD: Design process, Applications of computer for design, Creating the Manufacturing Database, The Design workstation, Graphical Terminal, Operator input Devices, Plotters and other devices, Central Processing Unit, Memory types.

MODULE – II (14 HOURS)

Computer graphics Software and Database: Configuration, Graphics Packages, Constructing the Geometry, Transformations of geometry, Database structure and content, Wire frame versus solid modeling, Constraint– Based modeling, Geometric commands, Display control commands, Editing.

MODULE III (14 HOUR)

CAM - Numerical Control and NC Part Programming: Numerical Control, Numerical Control elements, NC Cordinate system, NC motion control system, Manual and Computer Aided programming, the APT language, Miscellaneous Functions, M, Advanced part-programming methods.

Problems with conventional NC, NC technology: CNC, DNC, Combined DNC/ CNC system, Adaptive control manufacturing systems, Computer Integrated Manufacturing system, Machine Tools and related equipment, Materials Handling system: AGV, Robots, Lean manufacturing.

TEXT BOOKS :

1. CAD/CAM Computer Aided Design and Manufacturing, M.P.Goover and E.W.Zimmers, Jr., Pearson.
2. CAD & CAM, J Srinivas, Oxford University Press

REFERENCE BOOKS:

1. CAD/CAM Theory and Practice, Zeid and Subramanian, TMH
2. CAD/CAM Principles, Practice and Manufacturing Management, McMahon and Browne, Pearson Education
3. CAD/CAM Concepts and Applications, C.R.Alavala, PHI
4. Computer Aided Design and Manufacturing, Lalit Narayan, Mallkarjuna Rao and Sarcar, PHI
5. CAD/CAM Theory and Conepts, K.Sareen and C.Grewal, S.Chand Publication
6. CAD/CAM/CAE, N.K.Chougule, Scitech

PME6J004 COMPRESSIVE FLOW & GAS DYNAMICS

(PROFESSIONAL ELECTIVE)

Module I: (10 hours)
Fundamentals of Fluid dynamics and Thermodynamics: continuity equation, Momentum equation, Energy equation of incompressible flow Introduction to compressible flow: Introduction, Isentropic flow in a stream tube, speed of sound, Mach waves; One dimensional Isentropic Flow: Governing equations, stagnation conditions, critical conditions, maximum discharge velocity, isentropic relations

Module II: (10 hours)
Normal Shock Waves: Shock waves, stationary normal shock waves, normal shock wave relations in terms of Mach number; Oblique Shock Waves: Oblique shock wave relations, reflection of oblique shock waves, interaction of oblique shock waves, conical shock waves; Expansion Waves: Prandtl-Meyer flow, reflection and interaction of expansion waves, flow over bodies involving shock and expansion waves

Module III: (10 hours)
Variable Area Flow: Equations for variable area flow, operating characteristics of nozzles, convergent-divergent supersonic diffusers Adiabatic Flow in a Duct with Friction: Flow in a constant area duct, friction factor variations, the Fanno line; Flow with Heat addition or removal: One-dimensional flow in a constant area duct neglecting viscosity, variable area flow with heat addition, one-dimensional constant area flow with both heat exchanger and friction

Module IV: (10 hours)
Generalized Quasi-One-Dimensional Flow: Governing equations and influence coefficients, solution procedure for generalized flow with and without sonic point; Two-Dimensional Compressible Flow: Governing equations, vorticity considerations, the velocity potential, linearized solutions, linearized subsonic flow, linearized supersonic flow, method of characteristics.

Text Books
P. H. Oosthuizen and W. E. Carscallen. Compressible Fluid Flow. NY, McGraw-Hill, 1997.
H. W. Liepmann, and A. Roshko, Elements of Gas Dynamics, Dover Pub, 2001.
A. H. Shapiro, Compressible Fluid Flow 1 and 2. Hoboken NJ: John Wiley.
References
M. A. Saad, Compressible Fluid Flow. 2nd ed. Upper Saddle River, NJ: Prentice-Hall, 1993.
F. M. White, Viscous Fluid Flow. 2nd ed. New York: McGraw-Hill, 1991.

PME6J005 AUTOMOBILE ENGINEERING

(PROFESSIONAL ELECTIVE)

MODULE I (14 HOURS)

Introduction
Main units of automobile chassis and body, different systems of the automobile, description of the main parts of the engine, motor vehicle act.

Power for Propulsion
Resistance to motion, rolling resistance, air resistance, gradient resistance, power required for propulsion, tractive effort and traction, road performance curves.

Breaking systems
Hydraulic breaking system, breaking of vehicles when applied to rear, front and all four wheel, theory of internal shoe brake, design of brake lining and brake drum, different arrangement of brake shoes, servo and power brakes.

MODULE II (12 HOURS)

Transmission Systems

Layout of the transmission system, main function of the different components of the transmission system, transmission system for two wheel and four wheel drives. Hotchkiss and torque tube drives.

Gear box : Sliding mesh, constant mesh and synchromesh gearbox, design of 3 speed and 4 speed gear box, over drive, torque converter, semi and fully automatic transmission.

Hookes joint, propeller shaft, differential, rear axles, types of rear axles, semi floating, there quarter floating and full floating types.

MODULE III (14 HOURS)

Front wheel Geometry and steering systems : Camber, castor, kingpin inclination, toe-in and toe-out, centre point steering condition for true rolling, components of steering mechanism, power steering.

Electrical system of an automobile : Starting system, charging system, ignition system, other electrical system.

Electrical vehicles:

History, electrical vehicles and the environment pollution, description of electric vehicle, operational advantages, present EV performance and applications, battery for EV, Battery types and fuel cells, Solar powered vehicles, hybrid vehicles.

TEXTBOOKS :

1. Automobile Mechanics , N.K.Giri, Khanna publishers
2. Automobile Engineering, K.M. Gupta, VolI & II, Umesh Publication

REFERENCE BOOKS

1. Automotive mechanics: William h. Crouse and Donald L. Anglin, TMH
2. The motor vehicle, Newton and Steeds
3. Automobile Mechanics, J. Heitner, East West Press
4. Automobile Engineering, Jain and Asthana, Tata McGraw Hill
5. Automobile Engineering, K.K.Ramalingam, Scitech
6. Automobile Engineering, Vol. I & II, Kirpal Singh, Standard Publications
7. A Text Book of Automobile Engineering, R.K.Rajput, Laxmi Publishers

PME6J006 NON CONVENTIONAL ENERGY SOURCES

(PROFESSIONAL ELECTIVE)

MODULE I (6 CLASSES)

1. Energy, Ecology and environment: Introduction, Classification of Energy Resources, Common Forms of Energy, Energy Chain, Advantages and Disadvantages of Conventional Energy Sources, Importance and Salient Features of Non-Conventional Energy Sources, Environmental and ecological Aspects of Energy use, Environment-Economy-Energy and Sustainable Development, World Energy Status, Energy Scenario in India.
   Energy Conservation and Energy Storage: Salient Features of "Energy Conservation Act, 2001", Various Aspects of Energy Conservation, Principles of Energy Conservation, General Electrical ECO's (Energy Conservation Opportunities),

MODULE II (15 CLASSES)

2. Solar Energy: Basics, The Sun as a Source of Energy, Sun, Earth Radiation Spectrums, Extraterrestrial and Terrestrial Radiations, Spectral Energy Distribution of Solar Radiation, Depletion of Solar Radiation, Measurements of Solar Radiation, Solar Time (Local Apparent Time), Solar Radiation Geometry, Solar Day Length, Empirical Equations for Estimating Solar Radiation(Hourly Global, Diffuse and Beam Radiations) on Horizontal Surface Under loudless and Cloudy Skies, Solar Radiation on Inclined Plane Surface only (empirical relations for numerical)

3. Solar Thermal Systems: Solar Collectors: Flat plate and concentric collectors, Solar Water Heater, Solar Passive Space - Heating and Cooling Systems, Solar Refrigeration and Air-Conditioning Systems, Solar Cookers, Solar Furnaces, Solar Green House, Solar Dryer, Solar Distillation (or Desalination of Water), Solar Photovoltaic Systems: Solar Cell Fundamentals, Solar Cell Characteristics, Solar Cell Classification, Solar Cell, Module, Panel and Array Construction, Solar PV Systems, Solar PV Applications.

MODULE III (08 CLASSES)

4. Wind Energy: Origin of Winds, Nature of Winds, Wind Turbine Siting, Major Applications of Wind Power, Wind Turbine Types and Their Construction, Wind Energy Conversion Systems (WECS), Effects of Wind Speed and Grid Condition (System Integration),
5. Biomass Energy: Photosynthesis Process, Usable Forms of Biomass, their Composition and Fuel Properties, Biomass Resources , Biomass Conversion Technologies, Urban Waste to Energy Conversion, Biomass Gasification ,Biomass Liquefaction, Biomass to Ethanol Production, Biogas Production from Waste Biomass, Energy Farming.

MODULE IV (08 CLASSES)

6. Geothermal Energy: Applications, Origin and Distribution of Geothermal Energy, Types of
   a. Geothermal Resource.
7. Ocean Energy: Tidal Energy, Wave Energy, Ocean Thermal Energy
8. Fuel Cell Technology: Types, Principle of operation, Advantages and disadvantages.

TEXT BOOK:

1. Solar Energy Technology: Sukhatme and Nayak, TMH
2. Renewable Energy Sources and Emerging Technology: D.P.Kothari and etal., PHI
3. Renewable Energy Sources & Conversion Technology: N.K.Bansal, Manfred Kleenman & Michael Meliss, TMH Publication.
4. Non Conventional Energy Sources: B.M Khan, TMH Publications

REFERENCE:

1. Renewable Energy Sources:Fundamentals & Applications:G.N.Tiwari & M.K.Ghosal, Narosa Pub
2. Non Conventional Energy Resources: D.S. Chauhan and S.K.Srivastava, New Age International
3. Non Conventional Energy Sources: H.P.Garg
4. Non-Conventional Energy Systems: G.D.Rai, Khanna publications
5. Renewable Energy, Godfrey Boyle, Oxford University Press

PMG6M001 ENVIRONMENTAL SCIENCE AND ENGINEERING

Module I

Multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness.

Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resoureces for sustainable lifestyles.

Module II

Ecosystems

Concept of an ecosystem.

- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem :-

a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Environmental Pollution Definition

- Cause, effects and control measures of :-

a) Air pollution
b) Water pollution
c) Soil pollution
d) Marine pollution
e) Noise pollution
f) Thermal pollution
g) Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.

- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

Module III

Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rahabilitation of people; its problems and concerns. Case Studies
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

Module IV

Human Population and the Environment

- Population growth, variation among nations.
- Population explosion – Family Welfare Programme.
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. R. Rajagopalan, Environmental Studies, Oxford University Press
3. Ajith Sankar, Environmental Mangement, Oxford University Press
4. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
5. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
6. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
7. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
8. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
9. Down to Earth, Centre for Science and Environment (R)

PEN6E101 BUSINESS COMMUNICATION AND SKILL FOR INTERVIEW

Course Objectives

- To develop communication competence in prospective engineers.
- To enable them to convey thoughts and ideas with clarity and focus.
- To develop report writing skills.
- To equip them to face interview & Group Discussion.
- To inculcate critical thinking process.
- To prepare them on problem solving skills.
- To provide symbolic, verbal, and graphical interpretations of statements in a problem description.
- To understand team dynamics & effectiveness.
- To create an awareness on Engineering Ethics and Human Values.
- To install Moral and Social Values, Loyalty and also to learn to appreciate the rights of others.
- To learn leadership qualities and practice them.

MODULE I

Communication Skill: Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Writing Skills, Technical Writing, Letter Writing, Job Application, Report Writing, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication.

MODULE II

Critical Thinking & Problem Solving: Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats, Mind Mapping & Analytical Thinking.

Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

MODULE III

Ethics, Moral & Professional Values: Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE.

MODULE IV

Leadership Skills: Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation.

Expected outcome:

The students will be able to

- Communicate effectively.
- Make effective presentations.
- Write different types of reports.
- Face interview & group discussion.
- Critically think on a particular problem.
- Solve problems.

- Work in Group & Teams
- Handle Engineering Ethics and Human Values.
- Become an effective leader.

References:

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.
3. Larry James (2016); "The First Book of Life Skills"; First Edition; Embassy Books.
4. Shalini Verma (2014); "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company
5. John C. Maxwell (2014); "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc.

PME6D003 POWER PLANT ENGINEERING

(HONOURS ELECTIVE)

MODULE- I (8 HRS)

1. INTRODUCTION
   Different sources (Conventional and non-conventional) of energy and the principle of power generation only, Types of power plant and site selection, overall view of a steam power plant.
2. STEAM GENERATOR
   Fossil fuel steam generators, classification, circulation in water tube boilers, Modern high pressure water tube boilers(both sub critical and super critical), Boiler mounting and accessories, Combustion equipment: air supply systems (Natural and Mechanical Draught Systems). Pulverized coal burning systems and Basics of Fluidized bed combustion, Feed water treatment (Necessity & general consideration only). Boiler performance calculations.

MODULE – II (10HRS)

3. FLOW THROUGH NOZZLES
   Types of nozzles and their area of application & related calculation, critical pressure & chocked flow, super saturated flow. Effect of friction and nozzle efficiency
4. STEAM TURBINES
   Turbine types, Variation of Pressure and Velocity in different types of turbines, Simple impulse Turbines, Flow through turbine blades and velocity diagram, Pressure - compounded impulse turbines and Velocity compounded impulse turbines. Turbine power and related calculations.

MODULE – III (10HRS)

5. REACTION TURBINES
   Reaction turbines Flow through blades and velocity diagram, degrees of reaction, Parsons turbine, power and related calculations, Blade height calculations, Losses in steam turbines, Reheat factor & condition line, Governing of turbines.
6. STEAM CONDENSER & CIRCULATING WATER SYSTEMS
   Types, Surface condenser, Performance calculation, Air removal methods, Vacuum & vacuum efficiency. Cooling towers.(types, principle of operation and performance)

MODULE – IV (8HRS)

7. NUCLEAR POWER PLANT

Introduction, Nuclear fuels, Nuclear fission, Reactor components, & materials and classification,, Boiling Water Reactor (BWR), Pressurized water Reactor (PWR),CANDU Reactor, Gas cooled Reactors, Liquid metal fast breeder Reactor. Heavy water Reactors .Waste disposal and Safety of Nuclear power plant

8. ECONOMICS OF POWER PLANT
   Basic definitions, cost of electrical energy(Fixed cost and operating cost), Types of tariff, Types of loads(typical load curves), Economic Load sharing

TEXT BOOKS

1. Power plant Engineering ; - By P.K. Nag (2nd edition) TMH
2. Power Plant Engineering by Arora and Domkundwar, Dhanpat Rai publications

REFERENCE:

1. 1.. Power Plant Engineering by Yadav
2. Power Plant Engineering by Rajput
3. Power plant technology : By E.I. Wakil TMH
4. Power Plant Engineering by C.Elanchezhian, Sarvanakumar, Vijayramnath, IK International Publishing house Pvt Ltd

PME6D001 ADVANCED FLUID MECHANICS

(HONOURS ELECTIVE)

MODULE I (08 HRS.)

Concept of continuum and definition of a fluid. Body and surface forces, stress tensor, Scalar and vector fields, Eulerian and Lagrangian description of flow. Motion of fluid element - translation, rotation and vorticity; strain rate tensor, continuity equation, stream function and velocity potential.

MODULE II (10 HRS.)

Transport theorems, constitutive equations, derivation of Navier Stokes equations for compressible flow. Exact solutions of Navier Stokes equations : plane Poiseuille flow
and Couette flow, Hagen-Poiseuille flow, flow between two concentric rotating cylinders, Stoke's first and second problem, Hiemenz flow, flow near a rotating disk, flow in convergent- divergent channels. Slow viscous flow: Stokes and Oseen's approximation,

MODULE III (10 HRS.)

Theory of hydrodynamic lubrication. Boundary layer: derivation, exact solutions, Blasius, Falkner Skan, series solution and numerical solutions. Approximate methods. Momentum integral method.

MODULE IV (08 HRS.)

Two dimensional and axisymmetric jets.Description of turbulent flow, velocity correlations, Reynold's stresses, Prandtl's Mixing Length Theory, Karman's velocity defect law, universal velocity distribution.

TEXT BOOK:

1. Advanced Fluid Mechanics, Som and Biswas, Tata McGraw Hill

REFERENCE BOOKS:

1. Fluid Mechanics, A.K.Mohanty, PHI
2. Fundamentals of Fluid Mechanics, Schlitching
3. Introduction to Fluid Mechanics, Shaughnessy, Oxford University Press
4. Fluid Mechanics:-Frank M .White, TMH
5. Fluid Mechnics:- Cengel and Cimbala, TMH

PME6D002 FLUID POWER AND TURBOMACHINERY
(Honours Elective)

Module I (12 hours)

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids and pnumeatics. Advantages and Disadvantages of Fluid control, Types of Hydraulic Fluids, physical, chemical and thermal properties of hydraulic fluids, selection of hydraulic fluid, fluid flow fundamentals. Hydraulic Pumps and Motors: Basic Types and constructions, ideal pump and motor analysis, Performance curves and parameters

Introduction to Turbomachines. Classification of Turbomachines. Second Law of Thermo dynamics - turbine/compressor work, Nozzle/diffuser work. Fluid equations - continuity, Euler's, Bernoulli's equation and its applications. Expansion and compression processes, Reheat Factor, Preheat Factor. Euler's Equation of Energy Transfer, vane congruent flow, influence of relative circulation, thickness of vanes, number of vanes on velocity triangles, slip factor, Stodola, Stanitz and Balje's slip factor. Suction pressure and net positive suction head. Phenomena of cavitation in pumps. Concept of specific speed, Shape number. Axial, Radial and Mixed Flow Machines. Similarity laws.

Module II (10 hours)

Flow through Axial flow fans. Principles of Axial fan and propeller. Application of fans for air circulation and ventilation. Stage pressure rise and work done. Slip stream and Blade Element theory for propellers. Performance and characteristics of Axial fans.

Module III (10 hours)

Flow through Centrifugal compressors. Stage velocity triangles, specific work. forward, radial and backward swept vanes. Enthalpy entropy diagram, degree of reaction, slip factor, efficiency. Vane less and vaned diffuser systems, volute as spiral casing. Surge and stall in compressors

Module IV (08 hours)

Axial turbine stages, stage velocity triangles, work, efficiency, blade loading, flow coefficient. Single stage impulse and reaction turbines, degree of reaction, 50% reaction turbine stage, Radial equilibrium and Actuator disc approach for design of turbine blades. Partial admission problems in turbines. Losses in turbo machines.

Text Books

1. S.M. Yahya, Turbines, Compreessors and Fans, Tata Mcgraw Hill.
2. V. Kadambi, Manohar Prasad, An introduction to energy conversion, Volume-3, new age International publishers
3. E. Rathakrishnan, Gas Dynamics, , PHI Learning Pvt. Ltd
4.Mohammed Kaleem Khan, Fluid Mechanics and Machinery, Oxford publications
5. Anthony Esposito, “Fluid power with applications”, Prentice Hall, 7th Edition, 2002.

Reference books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria& Sons
2. Gopalakrishnan G, Prithvi Raj D, "A treatise on Turbomachines", Scitec Publications, Chennai, 2002.
3. R.K.Turton, Principles of Turbomachinery, E & F N Spon Publishers, London & New York.
4. Herbert E. Merritt, “Hydraulic Control Systems”, John Wiley & Sons, 1967

PME6G001 MECHANICS OF SOLID

(MINOR SPECIALIZATION)

MODULE - I (10 LECTURES)

1. 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, Statically indeterminate problems.
   Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson's ratio, Bulk Modulus, Relationship between elastic constants.
2. Members in Biaxial State of Stress :
   Stresses in thin cylinders, thin spherical shells under internal pressure - wire winding of thin cylinders. Analysis of Biaxial Stress. Plane stress, Principal stress, Principal plane, Mohr's Circle for Biaxial Stress.

MODULE - II (11 Lectures)

3. Strain Deformation :
   Two dimensional state of strain, Mohr's circle for strain, Principal strains and principal axes of strain measurements, Calculation of principal stresses from principal strains.
4. Shear Force and Bending Moment for Simple Beams
   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. Simple Bending of Beams :
   Theory of simple bending of initially straight beams, Bending stresses, Shear stresses in bending, Distribution of normal and shear stress, beams of two materials, 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:
   Eccentric loading of a short strut, Long columns, Euler's column formula, Lateral buckling, Critical Load, Slenderness ratio

MODULE - IV (7 LECTURES)

8. Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Stresses due to combined bending and torsion, Strength of shafts in combined bending and twisting.
9. 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 James M. Gere and Barry J. Goodno, Cengage Learning

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

Student Edition
4. Mechanics of Materials by James M. Gere, Thomson Learning
5. Engineering Machanics of Solids by Egor P. Popov, Prentice Hall of India
6. Strength of Materials by S.S.Rattan, Tata Mc Graw Hill
7. Strength of Materials by R.Subramaniam, Oxford University Press
8. Strength of Materials by Sadhu Singh, Khanna Publishers