

SEMESTER : FIFTH

5ME01

PRODUCTION TECHNOLOGY

Section - A

UNIT I : Concept of quality and quality control, quality of design and quality of conformance, Quality characteristics, Cost of quality & Value of quality, Specification of quality, quality control & inspection. Concept of TQM & Quality assurance, Concept of variation, variable and attribute data, Frequency distribution, Measures of Central tendency- Mean, mode & median, Measures of dispersion. -Range, std. deviation & variance.
(8)

UNIT II : Concept of universe and population, Normal distribution curve; Control charts for variables, process capability, Control charts for attributes; comparison between variable charts and attribute charts; precision & accuracy, Sampling plans, Operating Characteristic curve, Quality circle.
(8)

UNIT III : Basic principles of work study : definition, method study, introduction, objective, procedure, process charts, flow process charts, operation process chart, principles of motion economy, work place layout, multiple activity chart, two handed process chart, simo chat. Work measurement: definition, techniques, time study, rating system, allowances, std, time estimation, PMTS, MTM.
(7)

Section - B

UNIT IV : Standards of measurements: line standards, end standard, wave length standard. Limits, fits and gauges : terminology of limits, Fits and gauges, concept of interchangeability, allowance tolerance, Indian Standard Specification for limits, fits and gauges, B.S. System. Limit gauging - design of Go, No Go gauges.
(8)

UNIT V : Linear measurement: various comparators such as mechanical, electrical, optical, pneumatic comparators, their principle, operations and applications. Angular measurements: vernier, optical, bevel protractor universal bevel protector, Sine bar level clinometers, taper gauges. Thread measurement: screw thread limit and fit limits gauging of screw threads
(8)

UNIT VI : Gear measurement : alignment error, master gear, Parkinson tester. Study and use of optical dividing head, auto collimator, tool makers microscope. Interferometry, flatnesstesting, squareness testing. Surface texture testing. Coordinate measuring machine- types, role and application.
(7)

Books Recommended:

Text Books:

1. Engineering Metrology – R.K.Jain - Khanna Publishers.
2. Statistical Quality Control- M. Mahajan – Dhanpatrai & Com. Pvt. Ltd.
3. Work Study; ILO

Reference Books:

1. Quality Control - By Juran - Mc. Graw Hill Pub. Company.
2. Statistical Quality Control- By Grant E.L. – R.S.L.Leavgen Worth-. Mc. Graw Hill Pub. Company
3. Statistical Quality Control- By Gupta - Dhanpatrai & Com. Pvt. Ltd

5ME02**HEAT TRANSFER****Section - A****UNIT - I :-**

Introduction, heat transfer in engineering, modes of heat transfer, basic laws of heat transfer and their basic equations. Conduction- thermal conductivity and thermal diffusivity effect of phase & temperature on thermal conductivity, one dimensional steady state heat conduction through slab, cylinder & sphere-simple and composite. Combined conduction- convection, overall heat transfer coefficient. General heat conduction differential equation. One dimensional steady state conduction with internal heat generation for infinite slab, wire & cylinder.

(8 Hrs)

UNIT II :-

Insulations, critical radius of insulation, Conduction through extended surfaces, analysis of a uniform C.S. fin, fin efficiency, fin effectiveness, Biot number. Introduction to unsteady state heat conduction, Newton's law of cooling, lumped heat capacity analysis.

(8 Hrs)

UNIT III :-

Radiation- general concepts and definitions, black body & grey body concept. Laws of radiation- Kirchoff's, Planck's, Stefan-Boltzman's, Wien's law. Concept of shape factor, emissivity factor and radiation heat transfer equation. (No numericals). Radiation errors in temperature, measurement, radiation shield.

(7 Hrs)

Section - B**UNIT IV :-**

Forced convection- heat convection, forced and natural convection, boundary layer theory, hydrodynamic & thermal boundary layers, boundary layer thickness. Laminar & turbulent flow over flat plate and through pipes & tubes (only concept, no derivation & analytical treatment). Dimensionless number and their physical significance Reynold, Prandtl, Nusselt, Grashoff number, empirical correlations for forced convection for flow over flat plate, through pipes & tubes & their applications in problem solving.

(8 Hrs)

UNIT V :-

Free convection- velocity and thermal boundary layers for vertical plate, free convection over vertical cylinder and horizontal plate/cylinder (only concept, no derivation & analytical treatment). Use of empirical correlations in problem solving. Condensation & Boiling - introduction to condensation heat transfer, film & drop condensation. Boiling heat transfer, pool boiling curves.

(7 Hrs)

UNIT VI :-

Heat exchanger - applications, classification, overall heat transfer coefficient, fouling. L.M.T.D. & E.N.T.U. methods, temperature profiles, selection of heat exchangers. Introduction to working of heat pipe with and without wick. (7 Hrs)

Text Books:-

1. Heat and Mass Transfer; R.K Rajput; S. Chand, New Delhi
2. Heat and Mass Transfer; V.M. Domkundwar; Dhanpat Rai & Co. Delhi

Reference Books:-

1. Heat Transfer; J.P. Holman; McGraw Hill
2. Heat Transfer; P.S. Ghoshdastidar; Oxford University Press, Mumbai
3. Heat Transfer; P.K. Nag; TMH.

5ME03

MEASUREMENT SYSTEMS

Section - A

- UNIT I :** 1. Generalized Measurement system: Significance of measurement, generalized systems. application of measuring instruments. Types of measuring instruments.
2. General configuration and functional elements of measuring instruments, types of inputs, various methods of correction for interferences and modifying inputs.
(6 Hrs)

UNIT II : General performance Characteristics:

1. Static characteristics, different types of errors, combination of component errors in overall systems.
2. Dynamic characteristics : General mathematical model of zero order, first order and second order instruments, response of first and second order instruments to following inputs step, ramp, impulse and frequency.
(10 Hrs)

UNIT III : Strain Measurement :

1. Types of strain gauges, strain gauge circuits, calibration, Temperature compensation, use of strain gauges on rotating shafts, selection and installation of strain gauges.
2. Pressure Measurements:
Basic methods of pressure measurement, manometers, Transducers-elastic, gravitational. elastic : diaphragm, strain gauge pressure cell, High pressure measurement Bridgeman type, low pressure Measurement - McLeod, Krudsen, ionisation, Thermal conductivity gauges.
(8Hrs)

Section - B

- UNIT IV :** 1. Force Measurement: Various mechanical. Hydraulic, pneumatic and electrical methods.
2. Torque and Power Measurements : Various mechanical, hydraulic & electric methods.
3. Flow Measurements : Construction- Venturi, orifice, Dall tube, Rota meter. Pressure probes- Pitot static tube, yaw tube anemometer, positive displacement flow meters, turbine meter, electro-magnetic flow meter.
(8 Hrs)

UNIT V : 1. Temperature Measurements : Standards, Various temperature measuring devices, Bimetallic strip, liquid in glass thermometer, pressure thermometers, thermo couples, electrical resistance thermometers, Thermistors, radiation Thermometers.

2. Liquid Level Measurements : Various methods such as single float, displacement or force transducers. Pressure sensitivity, bubbler or Page system, capacitance variation type (for both conducting and non conducting type liquids) Resistance variation type, Radioisotope.
(8 Hrs)

- UNIT VI :** 1. Speed Measurements : Various mechanical type tachometers, electrical types tachometers, stroboscope etc.
2. Vibration Measurements : Seismic, Strain gauge and piezoelectric accelerometers.
3. Displacement measurements : Linear and angular displacement measurements, LVDT, LDR, Capacitive & inductive pick ups.
(8 Hrs)

Text Books:-

1. Measurement Systems : - By Ernest O. Doebelins - MC Graw Hill.
2. Mechanical Measurement & Control: By D.S.Kumar.

References Book:-

1. Mechanical Measurements :- By T.G.Beckwith & N.L.Bulk - Addison Werllv.
2. Instrumental Measurement & Analysis : By Nakra Choudhari Tata Mc Graw Hill.
3. Mechanical Measurement & Instrumentation :By R.K.Rajput,Katsons Books Publications

5ME04

THEORY OF MACHINES-I

Section - A

UNIT I :-

1. Introduction to study of mechanisms, machines, basic definitions, different types of links, kinematic pairs. Grashof's law- class-I and class -II mechanisms. Grubler's criterion, Kutrbach's theory. Inversions of four bar, single slider, double slider mechanisms,.
2. Kinematic analysis of mechanisms:- Transmission angle, Mechanical Advantage, coupler curve and their properties, radius of curvature of coupler curves..

(8 Hrs)

UNIT II :-

1. Velocity analysis:- Relative velocity method, method of equivalent mechanisms, Instantaneous centre of rotation method, body and space centroids,.
2. Acceleration analysis:- Relative acceleration method, analytical method and, Klein's construction for slider crank mechanism.

(10 Hrs)

UNIT III :-

Synthesis of Mechanisms:- Introduction to type, number and dimensional synthesis, graphical method of two position, three position and four position synthesis for input output co-ordination, Overlay method, Freudenstien's equation, Blosch's method.

(7 Hrs)

Section - B

UNIT IV :-

Frictional torque in pivot and collar bearing. Brakes, Clutches, and Dynamometers: types, constructional details, operation & calculation of leading dimensions.

(8 Hrs)

UNIT V :-

Special purpose mechanisms:- Steering mechanisms, Geneva wheel mechanism.

Cams:- Introduction, types of cam & follower, different motions of followers, graphical layout of cam profiles, cam with specified contours.

(8 Hrs)

UNIT VI :-

I) Gear :- Introduction, terminology, gear tooth profiles, involometry, interference, spur, gears, spiral gears, and its efficiency,

II) Gear Trains:- Types of gear trains, speed ratio applications.

(8 Hrs)

Books Recommended:

Text Books:

- 1) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
- 2) Theory of Machines and Mechanisms, J.E.Shigley, Uicker and Gordon, Published by Oxford University press-New York.
- 3) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by Eurasia Publishing house-N Delhi.

Reference Books:

- 1) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
- 2) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai and sons-N Delhi.
- 3) Theory of Machines and Mechanisms, Rao J.S. and Gupta K.N., Published by Wiley Eastern-N Delhi.
- 4) Machines and Mechanisms (applied kinematic analysis), David H. Myszka, Published by Pearson Education –Asia.
- 5) Mechanisms Design (analysis and synthesis), Arthur G.Erdman and George N.Sandoor, Published by Prentice Hall Inc.
- 6) Theory of Machines and Mechanisms,Ghosh and Amitabh,Published Affiliated East West Press, N-Delhi.

5FEME05**FREE ELECTIVE-I****1) MANUFACTURING TECHNIQUES****Section A**

Unit I Overview of manufacturing: Manufacturing science, Introduction to various activities in manufacturing, Properties and application of common ferrous and non-ferrous metals, Common methods of manufacturing, Selection of manufacturing process, Selection of material.

(6Hrs)

Unit II Various Machining operations – Turning, planning, shaper, milling, drilling, boring and grinding process. Introduction to tools and equipments required to perform various operations.

(8Hrs)

Unit III Introduction to metal forming and sheet metal process: Forming process- Forging, rolling, extrusion, wire drawing. Sheet metal processes- Forming, bending, drawing, coining, embossing. Cutting process: Punching, blanking, shearing, lancing.

(7Hrs)

Section B

Unit IV Casting: Steps involved in casting, advantages of casting, pattern, difference between pattern and casting, pattern allowances, material used for patterns, molding sand, sand mould making core, types of cores, defects of castings, melting furnace(Cupola), casting process and its applications.

(6Hrs)

Unit V Joining process with its types, advantages and disadvantages of riveting, soldering, brazing. Arc welding, gas welding, resistance welding, friction welding.

(6Hrs)

Unit VI Powder metallurgy: Methods of production of metal powder, steps in powder metallurgy, mixing and blending, compaction, sintering and finishing. Plastic part manufacturing: Process of extrusion, injection molding, blow molding, compression molding, transfer molding, advantages and disadvantages.

(7Hrs)

Books Recommended:**Text Books:**

1. Manufacturing processes –Workshop practice, R.A. Khan, Ali Hassan, Scitech Pub.
2. Workshop Technology -Hajra Chaudhary, Dhanpat Rai and Sons.

References:

1. Processes and materials of manufacture E.P. Degarmo, Prentice Hall of India (PHI)
2. Material and processes in manufacturing Lindberg, Tata McGraw Hill Pub.

5FEME05

FREE ELECTIVE-I
2) ERGONOMICS

Section – A

Unit I –

Introduction to Ergonomics , Man machine system, brief history of ergonomics, introduction to human anatomy, posture and body mechanics, musculoskeletal problems in seating and standing
(8)

Unit II -

Anthropometry and Work Place Design, Anthropometric data, applying engineering anthropometry to work station design, work place design for standing and seated workers
(7)

Unit III -

Design of Manual Handling Task , Assessment of Work Load, Anatomy and biomechanics of manual handling & design of manual handling task , lifting , lowering and carrying, grasping and pinching, physiology , workload and work capacity. (7)

Section – B

Unit IV -

Environmental Factors, Auditory environment- basic principles, Noise & vibration, measurement of sound, noise exposure and hearing loss, annoyance & distraction, interference with communication, structure of ear, Thermal environment-basic principle, factors affecting the human comfort, physical work and heat stress, visual environment- basic principle, main factors in visual environment, illumination and color, lighting, glare Whole body vibration , segmental vibration, sources of vibration, discomfort
(8)

Unit V -

Design of controls and tools, Design of controls, symbols, labels, visual displays of dynamic information, design and selection of tools
(7)

Unit VI -

Applications of ergonomics in various fields, Human errors, accidents & safety.
(7)

Books recommended

Text books –

1. Introduction to Ergonomics by R S Bridger, Edition 1995, Mc Graw Hill International.

Reference books –

1. Human Factors in Engineering & Design by Mark S Sanders and Ernest J. Mc Cormick, Seventh Edition, Mc Graw Hill International
2. Ergonomics in manufacturing , Edited by Waldemar Karwowski & Gavriel Salvendy, Engineering Management Press (EMP), Georgia
3. Industrial Ergonomics; M.I. Khan; PHI.

SFEME05

FREE ELECTIVE-I

3) PRODUCTION MANAGEMENT

Section -A

- UNIT I Designing products, services and processes; Historical evolution of productions and operations management, new product designs, manufacturing process technology.
Flexible manufacturing systems(FMS) and computer integrated manufacturing(CIM), design of services and service processes, tools for product development.
Standardization, simplification, specialization, diversification, product analysis.
- UNIT II Forecasting & Facility Location: Types of forecasting models, selection of the forecasting model, need for facility location planning, procedures for facility location planning, facility location planning, facility location models & facility payout planning.
- UNIT III Job Design & Capacity Planning: effective job design, production and operations standards, method study, work measurement, capacity measuring , capacity planning modeling, capacity strategies.

Section -B

- UNIT IV Aggregate Planning for Production & Scheduling: Operation planning and scheduling systems, the aggregate planning process, strategies for developing aggregate planning, master scheduling and rough cut capacity planning, aggregate planning for service organizations, loading sequencing, expediting.
- UNIT V Inventory Control: Demand and control system characteristics, inventory concepts, costs Modeling, Deterministic inventory models, stochastic inventory models, inventory control application, just-in-time manufacturing.
- UNIT VI Quality Management: Quality and quality related costs, quality function deployment(QFD), Taguchi's off-line quality control methods, managerial responsibility in managing for quality products & services. TQM. Failure analysis, bath tub curve, Reliability of system, Maintainability and availability.

Text Books:

1. Production and operations management- concepts models and Behaviour by Everett E. Adam,Jr., & Ronald J. Ebert (Prentice- Hall of India)
2. Production and operations management – Total Quality and responsiveness by Hamid Noori & Russell Radfort (Mc Graw Hill, Inc.)

References Books

1. Industrial engineering & production Management by M. Mahajan (Dhanpat Rai & Co.)
2. Industrial engineering & management by O.P.Khanna(Dhanpat Rai & Co.)
3. Production and Operations Management; J.P. Saxena; McGraw Hill

SFEME05

FREE ELECTIVE-I

4) PROJECT MANAGEMENT

Section -A

- UNIT I Concepts of Project & Project Selection : Project & development, concept of a project, external causes of delay, Internal constraints, criteria for project selection models, Types of project selection models, Analysis under high uncertainty, project proposals.
- UNIT II Project organization and planning: organizational form, strategic variables, need for planning, project coordination, negotiation and conflict resolution.
- UNIT III Budgeting and Cost Estimation: estimating project budgets, improving the process of cost estimation, Life-cycle-costing, project cost reduction methods.

Section -B

- UNIT IV Scheduling and resource allocation ; Network Techniques CPM and PERT, Gantt Charts, resource constraints, resource loading, resource leveling, integrated resource management.
- UNIT V Project Control: monitoring and information systems MIS, purposes of control, types of control processes, project cost overruns and cost control, project audit.
- UNIT VI Issues in project Management: Multicultural, issues, project cost escalation, conflict zones in project management, appraisal processes, concepts and techniques, managing project resources flow, project feasibility study.

Text Books:

1. Text Book of Project Management by P. Gopalkrishnan & VE Rama Moorthy (MacMillan India Ltd)
2. Project Management – A Managerial Approach by Jack R. Meredith & Samuel J. Mantel, Jr. (John Wiley & Sons Inc.)

Reference Books:

1. Project Management by Clifford F. Gray/Erik W. Larson (Mc Graw Hill).
2. Project Management by Prassana Chandra.

5ME06

PRODUCTION TECHNOLOGY-LAB.

Practicals : At least six from the below list.

Minimum Six experiments from the following list:

1. Determination of Linear/Angular dimensions of a given specimen/part using Precision/Non-Precision Measuring instruments.
2. Precision Angular Measurement using Sine Bar/Sine Centre, Autocollimator/Angle Dekkor.
3. Measurement of Gear Tooth Thickness by Gear Tooth Vernier Caliper/Constant Chord/Span Micrometer.
4. Measurement of Circularity/Roundness of a given specimen.
5. Measurement of Screw Thread Element by Floating Carriage Micrometer.
6. Testing of Surfaces by using Optical Flat.
7. Measurements of various angles of single point cutting tool by using Profile Projector and Tool Maker's Microscope.
8. Preparation of X and R chart for the given lot of sample.
9. Preparation of process chart.

Practical Examination :

The practical examination shall consist of oral on term work and syllabus taken jointly by Internal and External examiner.

5ME07

HEAT TRANSFER-LAB.

List of Practical (Any six of the following):-

1. Determination of thermal conductivity of a metal bar.
2. Determination of thermal conductivity of insulating powder.
3. Study of heat transfer through composite wall.
4. Study of heat transfer through composite cylinders.
5. Determination of fin efficiency.
6. Verification of Stefan-Boltzman's law.
7. Determination of emissivity of grey body.
8. Determination of heat transfer coefficient for forced convection.
9. Determination of heat transfer coefficient for natural convection.
10. Study of pool & nucleate boiling.
11. Trial on double pipe heat exchanger.
12. Determination of efficiency of cross flow heat exchanger.
13. To write a computer program for conduction heat transfer problem.

Practical Examination:- The practical examination shall consist of oral on the term work and syllabus.

5ME08**MEASUREMENT SYSTEMS-LAB.****List Of Practicals :**

Atleast of eight practicals from the following list.

1. Measurement of strain using strain gauges.
2. Calibration of pressure gauge with pressure gauge tester.
3. Measurement of linear displacement by LDR and inductive pick-up transducers.
4. Performance of capacitance transducer as a angular displacement measuring device.
5. Performance of inductive Transducers.
6. Flow measurement.
7. Speed measurement by a stroboscope.
8. Speed measurement by magnetic pick up or phot electric pick up tachometer.
9. Pressure measurement by strains gauge type transducer.
10. Vibration measurement.
11. Liquid level measurement.
12. Temperature measurement.

The practical examination shall consist of viva-voce on the above syllabus & practical work.

5ME09**THEORY OF MACHINES-I-LAB.**

PRACTICALS:- At least eight practicals from the below list shall be performed.

1. Study of inversion of four bar mechanism.
2. Study of inversion of slider crank mechanism.
3. Study of inversion of double slider crank mechanism.
4. Study of velocity analysis by relative velocity method/ pole technique.(2 Prob)
5. Study of acceleration analysis by relative acc. method. (2 Prob)
6. Study of brakes.
7. Study of clutches.
8. Study of dynamometer.
9. Study of Graphical layout of cam profile. (3 Prob.)
10. Study of gear trains
11. Problem in position synthesis.
12. Problem in input/output coordination
13. Computer aided synthesis of four bar mechanism.

The practical examination shall consist of viva-voce on the above syllabus & practical work.

5ME10**COMPUTER SOFTWARE APPLICATIONS-I –LAB.**

1. 2D & 3D CAD modeling methodology using packages like AutoCAD, CATIA, Pro-E, Solidedge, Unigrpahics, etc..
2. Creation of 2D Drawing (Sketching module) of any three mechanical machine component using any modeling /drafting software.
3. Creation of 3D drawing (part Module) of any three mechanical machine parts using any modeling software.
4. Creation of an assembly using (assembly module) various machine 3D parts using any modeling software.
5. Creation of 3D detailed part for any sheet metal components using 3D Product modeling software.
6. Creation of any one mechanism/animation using any modeling software.

At least five practicals from the above list should be performed.

Practical Examination:-

It shall consist of viva-voce based on term work and syllabus to be examined by internal and external examiner.

6ME01

**SEMESTER : SIXTH
FLUID POWER-II**

Section - A

Unit I : 1. Prime Movers :- Theory of impulse and reaction machines. Pelton, Francis and Kaplan turbines, their construction, classification, analysis, characteristics and governing, draft tube, unit quantities.

(8)

Unit II : Centrifugal pumps :- Basic Theory, classification, construction, operation, characteristics, multistage, NPSH and cavitations in pumps.

(7)

Unit III : 1. Axial flow pump :- Basic theory, construction, operation, and characteristics. 2. Other water lifting devices :-

(a) Air lift pump.

(b) Jet Pump.

(c) Hydraulic Ram.

3. Computational Fluid Dynamics (CFD): Basic Definition, Applications of CFD in the area of research & Industry. Comparison of Experimental Fluid Dynamics and Computational Fluid Dynamics, Importance of Governing Equations and the physical meaning of the involved terms. Equation of continuity, equation of motion & energy balance equation in Cartesian & cylindrical polar coordinates.

(10)

Section - B

Unit IV : Positive displacement Pumps :-1. Reciprocating Pumps :- Basic theory, types, construction, installation and characteristics. 2. Rotary Pumps :- Basic theory, types, construction and variable delivery pumps.

(9)

Unit V : Compressible fluid flow :- Perfect gas relationship, speed of sound wave, mach number, Isothermal and isotropic flows, shock waves, fanno and Rayleigh lines.

(8)

Unit VI : 1. Hydrostatic systems, their function, components and application such as Hydraulic press, lift, crane and fluid drive for machine tools. Intensifier and accumulator

2. Hydrokinetic systems : Fluid couplings and torque converter.

(8)

Books Recommended :-

Text Books:-

- 1.CSP Ojha, R. Berndtsson, Fluid mechanics and machinery; Oxford university.
2. Bansal R.K., Fluid mechanics and fluid machines; Laxmi publications.

Reference Books:-

- 1.Jagdish Lal, Hydraulic machines; Metropolitan Book Co. Pvt. Ltd.
2. Dr. Mody & Seth, Hydraulics and Fluid Mechanics; Standard house book.
3. Sen gupta, Computational fluid dynamics; Pearson Publishers.
4. Sameer sheikh, Iliyas Khan, Treaties on Hydraulics; Pneumatics, R.K. Publication.

6ME02

COMPUTER SOFTWARE APPLICATIONS

Section -A

Unit I

Introduction to data base management system (DBMS): Database system application, purpose of database systems, view of data, database languages, relational databases, database design, object based and semi structured databases, data storage and querying, transaction management, data mining and analysis, database architecture, database users and administrators.

(6 Hrs)

Unit II

Relational Databases: Structure of relational database, Fundamental relational algebra operation, Additional relational algebra operation, extended relational algebra operation, Null values, Modification of the database.

(6 Hrs)

Unit III

Database design and the E-R model: Overview of the database process, The entity- relational model, Constraints, Entity- relationship diagrams, Entity- relationship design issues, Weak entity sets, Extended E-R features, Database design of banking enterprise, reduction to relational schemas, other aspects of database design the unified modeling languages. (8 Hrs)

Section-B

Unit IV

Structured Query Language(SQL) : Introduction, data definition, basic structure of SQL queries, set operations, Aggregate functions, null values, nested sub queries, complex queries, view, modification of the database, joined relations, SQL data types and schemas, integrity constraints.

(8 Hrs)

Unit V

Relational Database design: Features of good relational design, atomic domains and first normal forms, decomposition using functional dependencies, functional-dependency theory, decomposition using functional dependencies, decomposition using multi valued dependencies, more normal forms, database design process, modeling temporal data. (8 Hrs)

Unit VI

Modeling and Simulation : Model, Types of model, advantages of modeling, need of system modeling, system approach to modeling, Introduction to simulation, modeling of simulation, environment, component of system, steps in simulation, advantages and disadvantages of simulation, simulation Languages and packages.

(6 Hrs)

Books Recommended:

Text Books:

1. Database system concepts –A. Silberschatz, H. Korth, Mc-Graw-Hill, 5th Edition.
2. System Simulation –G. Gordon, Prentis Hall international publication
3. Database Management systems; Raghu Ramkrishnan, Johannes Gehrke; McGra Hill International

Reference Books:

1. An Introduction to Database system –C. J. Date, Addison Wesley publication
2. System Simulation with digital computer – Narsingh Deo, Prentis Hall international

6ME03

CONTROL SYSTEM ENGINEERING

Section - A

Unit I :- Introduction system concept, open & closed loop systems, Mathematical models of physical systems, transfer functions. Block diagrams reduction and signal flow graphs.

Unit II :- Basic control actions and Industrial controllers :- Classification of industrial automatic controllers, control actions, proportional controllers, obtaining derivative and integral control action, effects of integral and derivative control action on systems performance.

Unit III :- Transient Response Analysis :- Introduction Std. Test signals, steady state response of first and second order systems for step, ramp and impulse input, transient response specifications, steady state error & error constants.

Section - B

Unit IV :- Concept stability, necessary condition for stability, Rouths stability criterion, Root locus concept, construction of Root loci, systems with transportation lag.

Unit V :- Frequency Response methods :- Introduction, concept of Bode diagrams.

Unit VI :- Study of important automatic speed control systems in machine tools, Prime movers, system generators, etc. Analysis of performance characteristics.

BOOKS RECOMMENDED:-

TEXT BOOKS :

1. Modern Control System by Richard C. Dorf, Robert H. Bishop, 9th Edition 2007
2. Automatic Control Engineering by F. H. Raven Mc-Graw-Hill.

REFERENCE BOOKS:

- 1) Modern Control Engg. - by Katsuhiko Ogata, PHI, 4th Edition 2006.
- 2) Automatic Control Engg. - by Kuo B.C. & F. Golnaraghi, 10th edition 2008
- 3) Control System Engg. - by Nagrath & Gopal, 5th Edition 2006

6ME04

THEORY OF MACHINES-II

Section – A

UNIT I :-

1. Static equilibrium, superposition principle, Static force analysis applied to plane motion mechanisms, virtual work method, static force analysis without and with friction.

2. Theory of hydrodynamic lubrication, boundary lubrication, film lubrication, rolling friction, performance of bearing.

(9 Hrs)

UNIT II :-

1. D'Alemberts Principle. Engine force analysis-piston effort, thrust along connecting rod, side of cylinder, on the bearings, crank effort and turning moment on the crank shaft.

2. Dynamic equivalent system of connecting rod. Inertia of the connecting rod. Inertia force in reciprocating engines (graphical method).

3. Turning moment diagrams for two stroke, four stroke and multi cylinder engines, fluctuations of speed & energy, Flywheel requirements.

(8 Hrs)

UNIT III :-

1. Space mechanism:- Gyroscope, gyroscopic effect as applied to ship, aeroplane, 4 wheeler, 2 wheeler, universal joint.

2. Vehical dynamics :- Coefficient of adhesion, resistance to vehicle motion, relative drive effectiveness, braking of vehicles.

(7 Hrs)

Section - B

UNIT IV :-

Concept and basic terms of vibratory motions, types of vibrations, basic features or elements of vibrating systems, degree of freedom in mechanical vibratory system.

1. Longitudinal vibrations- Natural frequency of free longitudinal vibrations by equilibrium, energy and Rayleigh method. Effect of inertia constraint in longitudinal vibrations. Damped vibrations with mass, spring and dash pot. Definitions of logarithmic decrement, magnification factor, transmissibility, vibration isolation.
2. Transverse vibrations- natural frequency of free transverse vibrations. Effect of inertia constraints in transverse vibrations. Natural frequency of free transverse vibrations due to point load and uniform distributed load acting over a simply supported shaft. Frequency of free transverse vibrations of a shaft subject to a number of point loads by energy and Dunkerley's method
(9 Hrs)

UNIT V :-

1. Torsional vibration, single rotor systems, Two Rotor system, three rotor system, geared systems, Graphical method for multi rotor system.
2. Whirling of shaft & critical speeds.
(6 Hrs)

UNIT VI :-

Balancing of Machinery:- Static, & dynamic unbalance, balancing of rotating masses in same and different transverse planes, Balancing of single cylinder, multi-cylinder V and radial engines. Partial balancing of reciprocating masses. Balancing of linkages & machine.
(9 Hrs)

Books Recommended:

Text Books:

- 1) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
- 2) Theory of Machines and Mechanisms, J.E.Shigley, Uicker and Gordon, Published by Oxford University press-New York.
- 3) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by Eurasia Publishing house-N Delhi.

Reference Books:

- 1) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
- 2) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai and sons-N Delhi.
- 3) Theory of Machines and Mechanisms, Rao J.S. and Gupta K.N., Published by Wiley Eastern-N Delhi.
- 4) Mechanisms Design (analysis and synthesis), Arthur G.Erdman and George N.Sandoor, Published by Prentice Hall Inc.
- 5) Theory of Machines and Mechanisms, Ghosh and Amitabh, Published Affiliated East West Press N-Delhi.

6FEME05

FREE ELECTIVE-II

1) AUTOMOBILE ENGINEERING

SECTION - A

UNIT I :-

Classification of automobiles, chassis types, Power Unit- Functions, basic working of SI and CI engines, engine parts-types, construction and functions, Multiple cylinder engines, Firing order
(7 Hrs)

UNIT II :-

Fuel feed systems- fuel feed systems for petrol and diesel engines, Fuel pumps, fuel filters, Air filters, Basic principles of MPFI and CRDI. Multipoint Fuel Injection Systems (MPFI), Common Rail Diesel Injection

Systems(CRDI). Cooling system: purpose, types of cooling system, liquid cooling system-water jacket and ports, water pump and radiators, by pass recirculation system, temperature indicator, antifreeze mixtures.

(7 Hrs)

UNIT III :-

The electrical system. Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive. Ignition system:- Battery coil ignition system, Electronic ignition system

(7 Hrs)

SECTION - B

UNIT IV :-

Transmission system:- Layout, single plate friction clutch and multiplate clutch, clutch troubles and remedies. Gear Boxes:- Sliding mesh, constant mesh gear box, Propeller shaft, Hotchkiss drive, torque tube drive, differential.

(8 Hrs)

UNIT V :-

Braking system:- Mechanical, hydraulic brakes, power brakes, and vacuum brakes Steering system:- Function, types of linkages, steering gears, steering gear ratio, wheel balancing, wheel alignment, camber, castor, king pin inclination, toe-in & toe-out & their effects, Introduction to power steering.

(7 Hrs)

UNIT VI :-

Suspensions :- Rigid axle and independent suspension system, shock absorbers. Auto lubrication :- Types of lubricants, their tests and ratings, multi viscosity oils. Engine lubrication:- types of lubricating systems, full pressure system, dry sump system, oil pump, crankcase ventilation.

(6 Hrs)

Books Recommended

Text Books:-

1. Automobile Engineering- Vol. I & II; Kirpal Singh; Standard Publishers Distributors
2. Automobile Engineering; R.K. Rajput; Laxmi Publications, New Delhi

Reference Books:-

1. Automotive Mechanics; Crouse & Anglin; TMH.
2. Automotive Mechanics; J.Heitner; East West Press
3. Automotive Mechanics; S. Srinivasan; TMH.

6FEME05

FREE ELECTIVE-II

2) NON-CONVENTIONAL ENERGY SYSTEMS

Section - A

UNIT I :-

Introduction :- Renewable & Nonrenewable sources. Solar Radiation :- Solar constant, basic earth-sun angles. Spectral distribution of extra terrestrial radiations & its variation. Solar time, Direction of beam radiation, computation of radiation on inclined surfaces.

(7 Hrs)

UNIT - II :-

Radiation Transmission through covers:- Reflection and absorption of radiation, optical properties of cover systems transmittance effects of surface layers on transmittance, transmittance absorptance product. Solar Energy collections:- Heat transfer for solar energy utilization, flat plate collectors such as liquid & air collector. Introduction to various systems of concentrating collectors.

(7 Hrs)

UNIT III :-

Solar energy Utilization:- Application of solar energy in heating, cooling, pumping, power production, distillation, drying, solar cookers, solar pond, solar furnace. Solar Energy Storage :- Methods of storage such as sensible, latent heat & thermo-chemical storage, selection of method of storage, properties of storage materials and different arrangements of storages. (No analytical treatment)

(7 Hrs)

Section - B

UNIT IV :-

Energy from Ocean:- Tidal Power:- types of tidal plants such as single and two basin plants, power developed & operation of tidal power plant. Ocean thermal energy conversion system. Ocean temp. profile, OTE power plant development, controlled flash evaporation, indirect vapour cycle. Wind Power:- Wind speed data, power in the wind, wind power development, types of wind mills, application for pumping and power generation. (No numerical)

(7 Hrs)

UNIT V :-

Biomass Energy Resources: Mechanism of green plant photosynthesis. efficiency of conversion, solar energy plantation, biogas – Types of biogas plants, factors affecting production rates. Pyrolysis, Gasifiess : Types & classification. Straight vegetable oils as a liquid fuels and their properties. Introduction to bio-diesel as a diesel engine fuel.

(7 Hrs)

UNIT VI :

Direct Energy Conversion:- Photo voltaic cells : Principle, concept of energy conversion, conversion efficiency, power output and performance, storage. Fuel Cells: Principles types of fuel cells, conversion efficiency. Geothermal Energy Resources, power generation methods like vapour dominated. water dominated, flash steam, binary fluid and total flow concept of power generation.

(7 Hrs)

Books Recommended:

Text Books:-

1. Solar Energy; S.P. Sukhatme; TMH
2. Non-Conventional Energy Sources; G.D. Rai; Khanna Publications

Reference Books:-

1. Treatise on Solar Energy; H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage; Bent Sorensen; Elsevier Publication
3. Renewable Energy; Godfrey Boyle; Oxford University Press, Mumbai
4. Renewable Energy Sources and Emerging Technology; D.P. Kothari, K.C. Singal, Rakesh Ranjan; PHI

6FEME05

FREE ELECTIVE-II

3) ENERGY MANAGEMENT

Section-A

UNIT-I

Introduction to energy, Sources of energy, Forms of energy, Energy reserves, renewable energy sources, Units of energy. Energy consumption and GDP. Need and importance of energy conservation and management

(7 Hrs)

UNIT-II

Energy audit concepts, Mass and Energy balances, Energy Auditing-methodology, analysis and reporting, Evaluation of energy conserving opportunities, Economic analysis and life cycle costing.

(
7 Hrs)

UNIT-III

Energy conservation in steam generation and supply system. Boiler performance, Boiler efficiency (direct and indirect method), excess air, flue-gas monitoring.

(7 Hrs)

Section - B

UNIT-IV

Energy conservation in compressed air systems, refrigeration and air-conditioning systems and water systems. Elementary coverage of energy conservation in pumps and fans. Opportunities in Process Industries for Energy conservation.

(7 Hrs)

UNIT-V

Electrical energy conservation in building lighting, heating, ventilating and air conditioning, Energy efficient motor, power factor improvement in power systems.

(9Hrs)

UNIT-VI

Energy environment interaction, Environmental issues, Global warming, Carbon dioxide emissions, Depletion of ozone layer, Government's regulations, Energy economy interaction.

(7 Hrs)

Books Recommended

Text Books:

1. P.H. Henderson; India – The Energy Sector; Oxford University Press.
2. D. A. Ray; Industrial Energy Conservation; Pergamon Press.

Reference Books:

1. W.S. Turner; Energy Management Handbook (Wiley)..
2. Rajan; Optimizing Energy Efficiency in the Industry, Tata McGraw Hill Publishers.
3. C.L Capehart; Guide to Energy Management, Fairmont Press.

6ME07

FLUID POWER –II-LAB.

Practical Term Work :

At least seven exercises based on the following.

- 1) Trial/study of Pelton turbine.
- 2) Trial/study of Francis turbine.
- 3) Trial/study of Kaplan Turbine.
- 4) Trial/study of centrifugal pump.
- 5) Trial/study of reciprocating pump.
- 6) Trial/study of Axial flow pump.
- 7) Study of multistage pump.
- 8) Trial/study of Hydraulic Ram.
- 9) Study of Hydrostatic components systems.
- 10) Study of Hydrostatic systems.
- 11) Study of Hydrokinetic systems.
- 12) Study of Cavitation phenomena.
- 13) Study of governing of Impulse Turbines.
- 14) Study of governing of reaction turbines.
- 15) Study of Special pumps (Air lift pump/jet pump)
- 16) Formulation of problem concerning the fluid flow in the vessel with any commercial code available like CFX, FLUENT, PHOENIX.

Practical examination shall consist of oral/and or experimentation based on above term work.

6ME08**COMPUTER SOFTWARE APPLICATIONS –II –LAB.****Practicals:**

1. At least four practical's using SQL for mechanical applications.
2. Demonstration of simulation packages

Practical examination shall consist of oral based on above term work and syllabus.

6ME09**THEORY OF MACHINES –II-LAB.****Practicals:-**

At least eight practical from the following list

- 1) Determination of inertia of simple pendulum.
- 2) Determination of inertia of compound pendulum.
- 3) Determination of inertia of irregular bodies.
- 4) Experiment on static balancing of rotating masses.
- 5) Experiment on dynamic balancing of rotating masses.
- 6) Determination of gyroscopic couple.
- 7) Experiment on whirling speed of shaft.
- 8) Determining the inertia force of connecting rod by
- 9) Dynamic force analysis of four bar mechanism
- 10) Experiment on free and damped vibration of systems with one degree of freedom.
- 11) Experiment on forced damped vibration of systems with one degree of freedom.
- 12) Experiment on free damped torsional vibration
- 13) Study of universal point.
- 14) Study of vehicle dynamics.

Practical Examination :-

It shall consist of Viva-voce on the above syllabus & Practical work.