7th /8th semester

BTME 801 INDUSTRIAL ENGINEERING & MANAGEMENT

1. Introduction:

Definition and scope of industrial engineering,–Functions of industrial engineering department and its organization, Qualities of an industrial engineer, concept of production and productivity.

2. Concepts of Management:

Functions of Management, Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs – Systems Approach to Management.

3. Designing Organizational Structures:

Concept, Importance and characteristics of organization, Types of organization - Project, matrix and informal organization. Span of control, Delegation of authority.

4. Management Planning, Decision Making and Control:

Steps, hierarchy, principles and dimensions of planning function, Approaches to decision making, Decision support systems, Basic control process, control parameters, principles of control.

5. Plant Location & Layout:

Plant location: definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection. Plant layout**:** Needs for a good layout, Different types viz. Product, process and combination layouts, Introduction to layouts based on the GT, JIT and cellular manufacturing systems, Development of plant layout.

6. Productivity:

Definition, reasons for low productivity, methods to improve productivity, relation between work-study and productivity.

7. Work Analysis:

Definition, need and scope of Work Analysis. Method-study: Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Principles of motion economy; Development and installation of new method. Work–measurement: Definition, various techniques of work-measurement such as work-sampling, stopwatch time study & its procedure, Job selection, Equipment and Forms used for work measurement, need for rating operator, methods of rating, allowances and their types, standard time. Standard data techniques.

8. Value Engineering:

Definition, Types of values, concept, phases and application of value engineering.

Books:

1. **Philip E** Hick, Industrial Engineering & Management, Tata McGraw Hill
2. Lawrence D. Miles, Techniques of Value Analysis and Engineering, McGraw Hill.
3. R.N. Nauhria, Rajnish Parkash, Management of Systems, Wheeler Publishers
4. S. Buffa, Modern Production Management, Wiley Eastern
5. H.S. Shan, Work Study and Ergonomics, Dhanpat Rai and Co. (P) Ltd.

BTME 802 REFRIGERATION AND AIRCONDITIONING

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

1. Basic Concepts:
Definition of Refrigeration and Air conditioning; Difference between Refrigeration and cooling; Difference between Refrigeration and Air conditioning; Brief history of Refrigeration and Air conditioning; Natural and Mechanical Refrigeration; Applications of Refrigeration and Air conditioning; Definitions of refrigerant, cooling/ Refrigeration effect, cooling capacity, heating effect, heating capacity; Units of refrigeration; Coefficient of performance and Energy Efficient Ratio; COP of a refrigerator; and COP/EPR of a heat pump; Single Phase Reversed Carnot cycle and its limitations; Two Phase Reversed Carnot cycle and its limitations; Methods of Refrigeration; Numerical.

2. Gas Cycle Refrigeration and Aircraft Refrigeration & Air conditioning:
Bell Coleman/Reversed Brayton/ Reversed Joule Cycle and its analysis; Numerical; optimum COP and pressure ratio (No mathematical Analysis); Applications of Gas Cycle Refrigeration; Necessity of aircraft refrigeration and air conditioning; Classification of aircraft refrigeration and air conditioning systems; Simple/basic aircraft refrigeration and air conditioning system (with and without evaporative cooler); Need of evaporator cooler; Boot Strap aircraft refrigeration and air conditioning system (with and without evaporative cooler); Regenerative aircraft refrigeration and air conditioning system; Reduced Ambient aircraft refrigeration and air conditioning system; Dry Air Rated Temperature (DART); Comparison of different aircraft refrigeration and air conditioning systems; Numerical.

3. Vapour Compression Refrigeration Cycle:
Vapour compression refrigeration system and its basic components; Representation of Simple/ TheoreticaL vapour compression refrigeration cycle on P-v, T-s and P-h diagrams; Dry versus wet compression; expansion versus throttling of liquid refrigerant; Analysis of Simple/Theoretical vapour compression refrigeration cycle; Introduction of P-h diagram/chart and Refrigeration Tables; Determination of properties of sub cooled, saturated and superheated refrigerant by using saturated properties & specific heat tables/saturated & superheated properties tables and P-h diagram; Compressor work and volumetric efficiency; Effect on performance and cooling capacity due to change in evaporator pressure, condenser pressure, sub cooling of liquid refrigerant, super heating of suction vapours, use of liquid - vapour regenerative heat exchanger; Effect on performance and cooling capacity due to heat exchange of vapours with compressor cylinder walls, pressure drop in suction (wire drawing) and discharge valves, pressure drop in evaporator and condenser; Actual vapour compression refrigeration cycle on T-s and P-h diagrams (No mathematical analysis); Numericals. Flash gas, its advantages and disadvantages, and its removal: flash chamber, liquid sub-cooler; Brief introduction (no mathematical analysis) to compound (multistage) compression, its advantages, schematic representation of these systems with use of flash chamber, water intercooler, flash intercooler, liquid sub-cooler (independent and combination of these); Brief introduction (no mathematical analysis) to multiple evaporator systems, schematic representation of these systems with use of

individual and multiple expansion valves arrangements, with single and multiple (individual and compound) compressor.

4. Vapour Absorption Refrigeration Cycle (No Mathematical Analysis):
Principle of vapour absorption refrigeration; basic components of the vapour absorption refrigeration system; Desirable properties of absorption system refrigerant and absorbent; Aqua - ammonia vapour absorption refrigeration system; Lithium Bromide - water absorption system (Single and double effect);Electrolux refrigeration system; comparison between vapour absorption and compression systems.

5. Refrigerants:
Classification and nomenclature of refrigerants; Desirable thermodynamic, chemical and physical properties of refrigerants; comparative study of commonly used refrigerants and their fields of application; Azeotropes; Zeotropes; Effect of moisture and oil miscibility; Refrigerants dying agents and antifreeze solution; leak detection and charging of refrigerants; environmental aspects of conventional refrigerants; Ecofriendly refrigerants and action plan to reduce ecological hazards.

6. Alternative Refrigeration Systems and Low Temperature Refrigeration:
(No Mathematical Analysis)
Steam Jet Refrigeration; Mixed Refrigeration Systems; Vortex Tube Refrigeration, Thermoelectric cooling; Transcritical Carbon Dioxide Compression Refrigeration; Cascade Refrigeration System; Linde and Claude cycles, cryogenics and its engineering applications.

7. Air Conditioning Concepts and Applications:
Psychrometry; Dry Air; Moist Air; Basic laws obeyed by Dry Air and Moist Air; Psychrometric properties of air: Dry bulb, wet bulb and dew point temperatures, Relative and specific humidity, degree of saturation adiabatic saturation temperature, enthalpy of air and water vapours; Psychrometric chart and its use; Adiabatic mixing of moist air streams without condensation and with condensation; Numerical.
Human requirement of comforts; effective temperature and comfort charts; Industrial and comfort air conditioning.

8. Psychometric Processes:
Basic psychrometric processes; Sensible heat process; Latent heat process;Total heat process; Sensible heat factor; Evaporative cooling; cooling with dehumidification; Heating with dehumidification; chemical dehumidification; By-pass factor; Contact factor; Psychrometric processes in air conditioning equipment: Cooling coils, Heating coils, cooling and dehumidification coils, Evaporative coolers, Adiabatic dehumidifiers, Steam injection, Air washer; Numerical.

9. Calculations for Air conditioning Load and for Rate and state of Supply Air:
Sources of heat load; sensible and latent heat load; Cooling and heating load estimation; Apparatus dew point temperature; Rate and state of supply air for air conditioning of different types of premises; Numerical

10. Refrigeration and Air Conditioning Equipment:
Brief description of compressors, condensers, evaporators and expansion devices; Cooling towers; Ducts; dampers; grills; air filters; fans; room air conditioners; split units; Package and central air conditioning plants.

Books:

1. C.P. Arora, Refrigeration and Conditioning, Tata McGraw Hill
2. Manohar Prasad, Refrigeration and Conditioning, Wiley Eastern Limited
3. Jordan and Priester, Refrigeration and Conditioning, Prentice Hall of India
4. W.F. Stoecker, Refrigeration and Conditioning, McGraw Hill

BTME 803 MECHANICAL VIBRATIONS

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

Detailed contents

1. Introduction:

Basic concepts, Types of vibration, Periodic & Harmonic vibrations, Methods of vibration analysis

2. Vibration of Single Degree of Freedom System:

Undamped free vibrations, damped free vibrations and damped force vibration system, Modelling of stiffness and damping (both viscous and coulomb), estimation of damping by decay plots, vibration isolation transmissibility, vibration measuring instruments.

3. Two degrees of Freedom systems:

a) Principal modes of vibrations, natural frequencies, amplitude ratio, undamped free, damped free, forced harmonic vibration, semi-definite systems, combined rectilinear & angular modes; Lagrange's equation.

b) Application to un-damped and damped absorbers: Vibration absorber – principle; centrifugal pendulum vibration absorber, torsional vibration damper, untuned dry friction and viscous vibration damper, torsional vibration abosrber.

4 Multi-degree of freedom systems:

Undamped free vibrations, influence coefficients, Generalised coordinates, orthogonality principal, matrix iteration method, Rayleigh and Dunkerley, Holzer's , Stodola method, Eigen values and eigen vectors

5. Continuous systems:

Lateral vibrations of a string, longitudinal vibrations of bars, transverse vibrations of beams, Euler's equation of motion for beam vibration, natural frequencies for various end conditions, torsional vibration of circular shafts

Books:

1. G.K. Grover, Mechanical Vibrations Hem Chand and Bros

2. K.K. Purjara, Mechanical Vibrations, Dhanpat Rai and Sons, Delhi

3. V.P.Singh, Mechanical Vibrations Dhanpat Rai and Sons, Delhi

4. Debabrata Nag, Mechanical Vibration, John Wiley India

5. Thomson, Mechanical Vibration, Prentice Hall

BTME 804 REFRIGERATION AND AIRCONDITIONING LAB

Internal Marks: 30 **External Marks: 20** **Total Marks: 50**

1. Study of various elements of a vapour compression refrigeration system through cut sections models / actual apparatus.
2. Study and performance testing of domestic refrigerator.
3. Study the performance testing of Electrolux refrigerator.
4. Study and performance testing of an Ice plant.
5. Calculation/ Estimation of cooling load for a large building.
6. Visit to a central Air conditioning plant for study of processes for winter and summer air conditioning
7. Visit to a cold storage for study of its working.
8. Study and performance testing of window type room air conditioner.
9. Study and performance testing of water cooler.

Subjects for Departmental Electives

Group-I

DE/ME-1.1 I. C. Engines

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction to IC Engines:

Definition of engine; Heat Engine, Historical Development of IC Engines, Classification & Nomenclature, Application of IC Engines, Air Standard Cycle, Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel cycle, Dual Cycle, Thermodynamics Analysis of these cycles.

2. Actual Working of I.C. Engine:

Working of 4 stroke petrol & diesel engines and their valve timing diagram, working of 2-stroke petrol & diesel engines & their valve timing diagrams, comparison of two stroke & four stroke engines, Actual working of 2 & 4 stroke gas engine and their valve diagram.

3. Fuel Air Cycles and their analysis:

Introduction to fuel air cycles and their significance, composition of cylinder gases, variable specific heats, Dissociation, effect of no. of moles, comparison of air standards & fuel air cycles, effect of operating variable like compression ratio, fuel air ratio, actual cycles and their analysis; Difference between Actual and Fuel-Air Cycle, Actual and Fuel-Air Cycles for S.I. and C.I. Engines.

4. IC Engine Fuels:

Introduction, types of fuels, solid, liquid and gaseous fuels, chemical structure of petroleum, petroleum refining process, important qualities of S.I. & C.I. Engine fuels and their rating. Combustion of fuels; Calorific valves of fuels, theoretical determination of CV of fuel, combustion equation for hydrocarbon fuels, determination of minimum air required for combustion, conversions of volumetric analysis of mass analysis, Determination of air supplied from volumetric analysis of Dry flue gases, Determination of excess air supplied , Determination of % of carbon in fuel burning to CO & CO2 , Determination of minimum quantity of air supplied to gaseous

5. Fuel Supply System:

Fuel Supply System and fuel pumps, properties of air fuel mixture, a sample carburetor an its working, approximate analysis of simple carburetor, Actual air fuel ratio of single jet carburetor, Exact analysis of single jet carburetor, ideal requirements from a carburetor, limitations of single jet carburetor, different devices used to meet the requirements of an ideal carburetor. Different modern carburetors, introduction to petrol injection, fuel injection systems for C.I.

6. Engines:

classification of injection systems, injection pump, injection pump governor, mechanical governor, fuel injection systems, injection pump Governor, Mechanical Governor, Fuel Injector, Nozzle, Injection of S.I. Engines, Fuel Filters.

7. Combustion in S.I. Engines:

Introduction, Stages of Combination in S.I. Engine, Flame font propagation, factor influencing the flame speed, ignition lag and factors affecting the lag, Abnormal combustion and knocking, control and measurement of knock, rating of S.I. Engine fuels and anti knock agents, combustion chambers of S.I. Engines

8. Supercharging:

Introduction, purpose of supercharging, type of superchargers, analysis of superchargers, performance of superchargers, Arrangement of Supercharger and its installation, Turbo charged engines, supercharging of S.I. & C.I. Engines. Limitations of supercharging.

9. Measurement and Testing:

Measurement of friction horse power, brake horse power, indicated horse power, measurement of speed, air consumption, fuel consumption, heat carried by cooling water, heat carried by the exhaust gases, heat balance sheet, governing of I.C. Engines, performance characteristics of I.C. Engines: Performance parameters, performance of S.I. Engines, performance of C.I. Engine, Engine performance maps

Books:

1. V. Ganesan, Internal Combustion Engines, Prentice Hall.

2. V. M. Damundwar, A Course in Internal Combustion Engines, Dhanpat Rai.

3. John B. Heywood, Internal combustion engine fundamentals McGraw-Hill,

4. Colin R. Ferguson, Allan Thomson, Kirkpatrick Internal combustion engines: applied thermo sciences, John Wiley & Sons

5. Richard Stone, Introduction to Internal Combustion Engines Society of Automotive Engineers,

DE/ME-1.2 CRYOGENIC TECHNOLOGY

Internal Marks: 40 External Marks: 60 Total Marks: 100

PART - I

1. History of cryogenic engineering; application of cryogenics

2. Properties of Oxygen, Nitrogen and Argon, and Hydrogen, Helium and rare gases

3. Thermal, mechanical and electrical properties of engineering materials at low temperature: Introduction to the phenomenon of superconductivity and its applications

PART - II

3. Thermodynamics of ideal liquefaction cycles; Joule-Thomson effect 3 Linde cycle; prncooled linde cycle; exercise

4. Claude, Heylandt, and kapitza cycles; exercises

5. Liquification of hydrogen and helium

PART-III

Heat exchangers and definition of effectiveness

1 Coiled tube (hampson type) and brazed Aluminum heat exchangers

2 Cryogenic expansion engines and turbines

PART -IV

1. Principal of binary Distillation

2. linde signal & double column system

PART -V

3. Types of cryogenic insulation: foam, fibre, powder vacuum

1. Liquid cryogen storage vessels and cryogen transfer line;

PART -VI

2. Measurement of temperature: gas and vapour pressure Thermometers, thermocouple, RTD and semiconductor sensors;

PART -VII

3. Safety in cryogenic systems fir, asphyxiation, cold burns and pressure problems

Books

1. Randall F. Barron, Cryogenic Systems, McGraw-Hill.

2. Marshall Sitting and Stephen Kidd D, Cryogenic Research amd Applications, Van Norstad

3. Russell Burton, Scott Cryogenic engineering, Van Nostrand,

DE/ME-1.3 NON-CONVENTIONAL ENERGY RESOURCES

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Renewable and non-renewable energy sources, their availability and growth in India; energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements.

2. Solar Energy:

Solar radiation - beam and diffuse radiation; earth sun angles, attenuation and measurement of solar radiation; Optical properties of materials and selective surfaces; Principles, general description and design procedures of flat Platte and concentrating collectors; Performance analysis of cylindrical and parabolic collectors; Solar energy storage systems - their types, characteristics and capacity; solar ponds. Applications of solar energy in water, space and process heating, solar refrigeration and air conditioning; water desalination and water pumping; solar thermal power generation; solar cells and batteries; economic analysis of solar systems.

3. Wind Energy:

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of accodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

4. Direct energy conversion systems:

i) Magnetic Hydrodynamic (MHD) Generator: gas conductivity and MHD equations; operating principle, types and working of different MHD systems – their relative merits; MHD materials and production of magnetic fields.

ii) Thermo-electric generators: Thermo-electric effects and materials; thermo-electric devices and types of thermo-electric generators; thermo-electric refrigeration.

iii) Thermionic generators: thermoionic emission and materials; working principle of thermionic convertors.

iv) Fuel Cells: thermodynamic aspects; types, components and working of fuel cells.

v) Performance, applications and economic aspects of above mentioned direct energy conversions systems.

5. Miscellaneous Non-Conventional energy Systems:

i) Bio-mass: Concept of bio-mass conversion, photo-synthesis and bio-gasification;

Bio gas generators and plants - their types constructional features and functioning; digesters and their design; Fuel properties of bio gas and community bio gas plants

ii) Geothermal: Sources of geothermal energy - types, constructional features and associated prime movers.

iii) Tidal and wave energy: Basic principles and components of tidal and wave energy plants; single basin and double basin tidal power plants; conversion devices Advantages/disadvantages and applications of above mentioned energy systems.

Books

1. H.P. Garg and Jai Prakash, Solar Energy : Fundamentals and Applications, Tata McGraw Hill.

2. S.P. Sukhatme, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill.

3. John A. Duffic and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley.

4. S. L. Sheldon, Chang, Energy Conversion, Prentice Hall.

5. O. M. Bockris and S. Srinivasan, Fuel Cells, McGraw Hill.

DE/ME-1.4 ENERGY CONSERVATION AND MANAGEMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

Need for energy conservation, its potentials, fiscal incentives, primary energy sources such as coal, gas, oil, nuclear fuel, Optimum use of prime movers for power generation such as steam turbines, gas turbines, diesel and gas engines, energy intensive industries i.e. iron and steel, aluminum, pulp and paper, textile and oil refineries and their energy usage pattern.

Plant Good house keeping measures in air conditioning boilers, combustion system, steam, furnaces and general awareness, Energy audit, methodology and analysis, Energy conservation case studies in air conditioning, boiler and burners

Waste heat recovery systems i.e. recuperates economizers waste heat boilers, heat pipe heat exchangers regenerators etc. energy storage systems thermal storage, insulation, refractory, specialized processes such as Dielectric & micro wave heating, electronic beam welding, Fluidized bed technology, laser as a welding tool, Alternative sources of energy.

Books

1. D.A. Reay, Industrial Energy Conservation Handbook, Oxford Press.

2. P. L. Diwakar Rao, Energy Conservation Handbook, Utility Publication Ltd.

3. Richard Greene, Process Energy conservation (Chemical Engineering), McGraw-Hill.

DE/ME-1.5 FLUID MECHANICS-II

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Potential Flow:

Stream function and velocity potential functions for standard flow patterns uniforms flow, source/sink, doublet and free vortex ; combination of uniform flow with certain flows to obtain flow patterns of various shapes such as flow past a half body, a cylinder, a Rankine oval body, and a cylinder with circulation : Kutta joukowski, Theorem-lift on a cylinder.

2. Viscous Flow:

Navier Stokes equation of motion; Relationship between shear stress and pressure gradient; two dimensional laminar flow between two fixed parallel planes ; Plain Couette flow and its application to hydro-dynamic theory of lubrication.

3. Turbulence:

Fluctuation velocity components; intensity and scale of turbulence; Reynolds equations and turbulence modeling.

4. Boundary Layer:

Salient features of flow pattern in a boundary layer; Velocity and shear stress distribution along the boundary; Von-Karman momentum integral equation, Quantitative correlation for boundary layer thickness, local skin friction coefficient and drag coefficient in laminar, turbulent and laminar turbulent combined boundary layer flows on a flat plate without pressure gradient; flow over a courved surface boundary layer separation and its control.

5. Flow Around Immersed Bodies:

Concept of friction, pressure, wave and induced drag- lift and drag coefficients; variation of drag coefficient with Reynolds number for two dimensional bodies (flat plate, circular cylinder) ; Vortex shedding from cylindrical bodies; effect of streamlining ; drag coefficient versus Reynolds number for flow past axisymmetric bodies (sphere) ; Terminal velocity ; Lift of an airfoil ; Airfoil of finite length-effect on drag and lift ; Downwash and induced drag.

6. Compressible Flow:

Wave propagation and sonic velocity; Mach number, Limits of incompressibility and compressible flow regimes; pressure field due to a moving source of disturbance, Mach cone and Mach angle. Basic equations for one-dimensional compressible flow; static and stagnation values; Isentropic flow relations; compressibility correction factor. Isentropic flow through a duct of varying cross-section, mass flow rate and choking in a converging passage. Normal shock and change in flow properties across a normal shock wave.

Books

1. B.S. Massey, ELBS and Van Nostrand, Mechanics of Fluids, Reinhold Co.

2. Richard H.F. Pao, Fluid Mechanics, John Wiley.

3. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria.

4. J.F. Douglas, J.M. Gasionckw, and J.A. Swaffield JP, Fluid Mechanics , Pitman.

5. V.L. Streeter and E.B. Wylie, Fluid Mechanics, McGraw Hill.

DE/ME-1.6 SOLAR ENERGY

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Solar Flux and Weather Data:

Introduction, Solar Constant, Spectrum of sun, Diurnal Variation of Direct Sunlight, Height variation of direct sunlight. Standard Atmosphere, Zenith Distance Flux Variation, Geographical distribution of sun-shine and effects of weather on Solar Flux. Introduction to solar Flux observation, Instruments such as pyranometer, Phyrheliometer and Sunshine Recorder, Correlation between direct and total Insulation, Solar flux variation dynamic, Correlation of sunshine with Wind Velocity, Environmental Thermal Infrared Flux and ETIR Model.

2. Solar Availability:

Introduction, Zenith Distance Vs time, Time of sunrise and sun-set fully Tracking collector, Variation of flux curves with latitude and geometry, Introduction tom Fixed Flat plate (horizontal, latitude Tilted, fixed latitude + 15°, Vertical South-facing, seasonally Tilted) N-S and horz, east west tracking and N-S polar east west tracking, East west horz and N-S tracking, Comparison of theoretical curves with observation, comparison of daily output; Peak flux Vs Average flux.

3. Heat Transfer in Solar Collectors:

Introduction, Heat Losses in a Distributed Collector system. The Liquid Transfer Module System, Solar Heat Availability, Fluid Mechanics, Fluid Properties, Temperature Rise, Solar Flux, Pressure Drop Relations, Reynolds Number, Ratio of Power Expended to Power Generated, Magnitude of Power Output/Input Ratio, Parametric Relationships for Fluid Transfer, Variation of Output/Input Ratio with Solar Flux. Air-Transfer Systems, Air Heat Transfer in Terms of Volume Rate of Flow, Typical Evaluation Situation. Alternative Forms of the Heat-Rise Equation, Effect of Changing Heat-Transfer Fluid, Heat Transfer in Evacuated Collectors, Thermodynamic Utilization of Collected Energy, Evacuated Collectot Trade offs. Linear Absorber with Air Radiation Suppression Using Honeycombs Convection Suppression Using Honey-combs, Heat Pipes, Heat Transfer alongh Thin Sheets, Differential Thermal Expansion, Problems.

4. Flat-Plate Collectors:

Introduction, Basic Collector Configurations, Diurnal Temperature, Profile, Thermal Inertia U-Factor, Collector Heat Balances. Sample Calculation, Surface Temperature. Efficiency versus-Temperature Curves, General Properties of an efficiency Vs Change and Temperature, The Bare Collector; Single –Window Collector, Double Window Collector Improvement of Performance, Geometrical Suppression of Convection, Window Temperature. Effect of Selective Absorber Surface, Selective Windows Facing Selective Surface Combination of Absorber and selective windows, Comparison of Thermal Behaviour for Selective Windows, Window Absorption Non reflection Coated Window, Variation of Efficiency with Solar Flux, Evacuated, Cooling, Selective Radioactive Cooling, Cylindrical Collector Structure Flat-Plate .Collector performance, Solar Ponds, Problems

5. Energy Storage:

Introduction, Basic System Diagram, Peaking Effect of Back up Demands, Energy Storage, Hydrostorage Chemical Batteries Flywheels Chemical Storage, Compressed Air, Biological Storage, Thermal Storage, Sensible-Heat Storage, Latent-Heat Storage, Salt Eutectics, Zoned Thermal Storage Fluid Tank, Rock Thermal Storage Tank, Thermal Storage Tank Farm, Heat Management with and without Phase Change, Thermal inertia, Calculation of Detailed Performance, Problems. Application of Solar Energy (History and Survey Application) Community Heating & Cooling system, Solar Water pumping, Solar gas absorption refrigeration, MEC Cooling system, Two stage evaporative cooling etc.

6. Direct Conversion to Electricity:

Introduction, Direct conversion by Means of Solar Ce4lls, Silicon Cells, Manufacture of Silicon Cells, Efg Ribbon Silicon Cells Polycry Stalline silicon cells, Cadmium sulfide Solar Cells, Manufacture of Cadmium Sulfide Cells Gallium Arsenide Solar Cells, Thermal Behaviors of Solar Cells Cooled Solar Cells for Concentrating System. Thermo-electric Solar Cells, Thermonic Solar Cells, Phase-Change Thermal Direct Conversion, Problems.

Books

1. Aden B.Meinel and Marjoric P.Meinel, An Introduction to Applied Solar Energy, Addison Wesley.

2. Jan F.Kreider and Fran Kreith, Hand Book of Solar Energy, McGraw-Hill.

DE/ME-1.7 Heat Exchanger Design

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Classification, types and applications of heat Exchangers, Heat Exchanger Design methodology, Selection of Heat Exchangers.

2. Single Phase Heat Exchangers:

LMTD and NTU methods, Rating and sizing methods, design criteria, geometry, process parameters, pressure drops and applications.

3. Two Phase Heat Exchangers:

Types of Boiling, Boiling mechanisms, two phase flow boiling pressure drop Condensation Mechanism, types of condensers and design procedures, Evaporators, Reboilers, Multiple effect evaporators, Design procedures, Liquid chillers, kettle, thermosyphen and forced circulation Reboilers, Augmented surface heat Exchangers, Heat transfer coefficients, pressure drops, compact heat exchangers and air coolers, plate heat exchangers and plate fine heat exchangers.

4. Heat Pipe Heat Exchangers:

Types and design procedure and applications Installation, Operation and Maintenance: Fouling factors, type of fouling and cleaning methods.

5. Mechanical Considerations:

Codes and Standards, Mechanical design requirements and materials.

Books

1. Saunders EAD, Heat Exchangers Selection Design and Construction, Longman Scientific and Technical, John Wiley.

2. D.Q. Kern, Process Heat Transfer International Edition, Mc. Graw Hill.

3. J.P. Holman, Heat Transfer, Mc. Graw Hill.

4. J.P Gupta, Fundamentals of Heat Exchangers and Pressure Vessels Technology, Hemisphere Publishing Corporation.

DE/ME-1.8 POWER PLANT ENGINEERING

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Energy sources for generation of electric power, Principles types of power plants-their special features and applications, Present status and future trends.

2. Hydro-Electric Power Plants:

Classifications, Components and their general layout, Hydroelectric survey, rainfall run-off, hydrograph, flow duration curve, mass curve, storage capacity, Site selection.

3. Steam Power Plant:

General Introduction, Developing trends, Essential features, Site

Selection, Coal-its storage, preparation, handling, feeding and burning, Ash handling,

dust collection, High pressure boilers.

4. Diesel and Gas Turbine Power Plants:

Field of use, components, Plant layout, Comparison with stream power plants, Operation of combined steam and gas power plants.

5. Nuclear Power Plant:

Nuclear fuels, nuclear energy, Main components of nuclear power plant, Nuclear reactors-types and applications, Radiation shielding, Radioactive waste disposal, Safety aspects.

6. Power Plant Economics:

Load curves, terms and conditions, Effect of load on power plant design, methods to meet variable load, prediction of load, cost of electric energy, Selection of types of generation and generating equipment, Performance and operating characteristics of power plants, Load division among generators and prime movers, Tariff methods of electric energy. Non-Conventional Power Generation: Geothermal power plants, Tidal power plants, Wind power plants, Solar power plants, Electricity from city refuge.

7. Direct Energy Conversion Systems:

Thermoelectric conversion system, Thermionic conversion system, Photo voltaic power system, Fuel Cells, Magneto-hydrodynamic system.

Books

1. P.K.Nag, Plant Engineering, Tata McGraw Hill.

2. G.R. Nagpal, Power Plant Engineering, Khanna Publishers.

3. S.C. Arora and S. Domkundwar, Power Plant Engineering, Dhanpat Rai.

DE/ME-1.9 GAS DYNAMICS

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Basic concepts of Gas Dynamics and Gas Properties:

Definition: Units and dimensions. The concepts of continuous, properties of the continuum. Methods of describing fluid motion, Lagrangian method. Eulerian Method. The integral form of the equations of Conservations of Mass. Momentum and energy as applied to Control Volumes, applications to the study flow of inviscid compressible fluids.

2. Fundamentals Equations Study of One Dimensional Flow:

Continuity equation, the momentum equation, the dynamic equation and Euller's equation. Bernoulli's equation, thrust function, steady flow energy equation.

3. Isentropic Flow:

Introduction, Acoustic velocity, Mach number, Mach line and Mach angle. Classification of flows, Karman's rules supersonic flow, flow parameters, Critical conditions stagnation values.

4. Flow in Ducts with Heating or Cooling:

Stagnation temp. change, governing equations, Rayleigh lines, choking effects in simple to change. Maximum heat transfer.

5. Flow in constant- Area Ducts with friction:

Friction loss, the friction parameter, Fannolines, effect of the increase of inlet Mach number and duct length. Chocking due to friction. Isothermal flow through long ducts.

6. Normal Shock Waves:

Formation of shock waves, weak waves, compression waves. Governing relations of the Normal shock, Pressure. Temperature, Density, Mach number across shock.

7. Oblique shocks: Oblique shock equations, shock geometry, shock polars.

8. Flow through Nozzles:

The Converging diverging nozzle, area ratio for complete expansion, effect of varying back pressure on nozzle flow. Under-expansion and over-expansion in nozzle flow. Losses in nozzle.

9. Flow through Diffusers:

Classification of diffusers, internal compression subsonic diffuser, velocity gradient, effect of friction and area change, the conical internal-compression subsonic diffuser, external compression subsonic diffuser, supersonic diffuser, normal shock supersonic diffuser, the converging diverging supersonic diffuser.

10. Introduction to Multidimensional Flow:

The equation of continuity, the momentum equations, Bernoulli,s equation, the energy equation, Navier-Stock' Equations, Potential Flow.

Books

1 Asher H. Shaprio, Thermodynamics of Compressible Fluid flow, John Wiley.

2. Culbert B. Laney, Computational Gas Dynamics, Cambridge University Press.

Group-II

DE/PE-2.0 Non Traditional Machining Processes

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Latest trends in Manufacturing, Introduction to Flexible manufacturing system, Introduction to computer integrated manufacturing, Limitations of conventional machining processes, Development of Non conventional machining processes, their classification, advantages and major applications

2. Advanced Mechanical Processes:

Ultrasonic machining, Water Jet Machining and Abrasive Flow Machining-elements of process, Applications and limitations

3. Electrochemical & Chemical Removal Processes:

Principle of operation, elements and applications of Electrochemical Machining, Electrochemical grinding, Electrochemical deburring, Electrochemical honing, Chemical Machining, Photochemical machining

5. Thermal Metal Removal Processes:

Electric Discharge Machining- Mechanism of metal removal, electrode feed control, die electric fluids flushing, selection of electrode material, applications. Plasma Arc Machining- Mechanism of metal removal, PAM parameters, Equipment's for unit, safety precautions and applications. Laser Beam machining- Material removal, limitations and advantages. Hot machining- method of heat, Applications and limitations. Electon-Beam Machining-, Generation and control of electron beam, process capabilities and limitations

6. Hybrid Machining Processes:

Concept, classification, application, Advantages

Books:

1. P.C. Panday and H.S. Shan, Modern Machining Processes, Tata Mc Graw Hill

2. G. Boothroyd and W.A. Knight, Fundamentals of Machining and Machine Tools, Marcel Dekker Inc.

3. G.F. Benedict, Non-traditional Manufacturing Processes, Marcel Dekker Inc.

4. V.K Jain, Advanced Machining Processes, Allied Publishers

5. Hassan Abdel, Gawad El-hofy Fundamentals of Machining Processes: Conventional and Nonconventional Processes, Taylor & Francis

DE/PE-2.1 INDUSTRIAL ENGINEERING

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Definition and scope of industrial engineering Role of an industrial engineering Role of an industrial engineer in industry, Functions of industrial engineering department and its organization, Qualities of an industrial engineer.

2. Plant Layout and Material Handling:

Different types of layouts viz. Product, process and combination layouts, Introduction to layouts based on the GT, JIT and cellular manufacturing systems, Development of plant layout. Types of material handling equipment, relationship of material handling with plant layouts.

3. Work-study:

Areas of application of work study in industry; Method study and work measurements and their inter-relationship. Reaction of management and labour to work study; Role of work study in improving plant productivity and safety.

4. Method Study:

Objectives and procedure for methods analysis: Select, Record, Examine, Develop, Define, Install and Maintain. Recording techniques, Micromotion and macro-motion study: Principles of motion economy, Normal work areas and work place design.

5. Work Measurement:

Objectives, Work measurement techniques - time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards. Observed time, basic time, normal time, rating factors, allowances, standard time.

6. Value Engineering:

Types of values, concept of value engineering, phases of value engineering studies, application of value engineering.

7. Work Design:

Concepts of job enlargement, job enrichment and job rotation. Effective job design considering technological and behavior factors.

8. Ergonomics:

Introduction to ergonomic considerations in designing man-machine systems with special reference to design of displays and controls.

Books

1. Gayler Shotbolt, Introduction to Work study, Tata McGraw Hill.

2. H.S. Shan, Work Study and Ergonomics, Dhanpat Rai and Co. (p) Ltd.

3. R. Bernes, Motion and time study by, John-Wiley.

4. D.J. Oborne, Ergonomics at work, John Wiley.

5. D. Miles, Techniques of Value Analysis and Engineering, McGraw Hill.

DE/PE-2.2 MODELING AND SIMULATION

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Modeling

Need for system modeling, systems approach to modeling, open and feed back systems, combination of simple feed back systems, feed back time lag effects, feed back and managerial systems

2. Production and Operations Management

Principle of analytical modeling, kinds of analytical methods, measures of effectiveness, cost analysis large systems

3. Simulation

Monte Carlo simulation, generation of stochastic variates, continuous and discrete probability distributions, application of Monte Carlo methods for production systems, computer simulation

models, Macro Dynamic models, examples from business and industry, design of management game, Simulation languages SIMULA, SIMSCRIPT, GPSS etc. Statistical output analysis.

4. Analog computer simulation;

Basic analog computer components and operations; amplitude and time scaling; solution of linear and non-linear partial differential equations, formulation of model for a dynamic system and its simulation on analog computer.

Books

1. Narsingh Deo, System Simulation with Digital Computer, PHI Learning.

2 G. Gordon, System Simulation, PHI Learning.

3. Jackson A.S, Analog Computation, McGraw-Hill.

4. Naylor T.H. et. al, Computer Simulation Techniques, John Wiley.

5. S. Buffa, Modern Production Management, John Wiley .

DE/ME-2.3 OPERATIONS MANAGEMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Need and Scope of Operation Management:

Types of production system and their characteristics, productivity definition, types and measurements

2. Product Design And Development:

Steps involved in product design and development, considerations of technical, ergonomic, aesthetic, economic and time factors. Use of concurrent engineering in product design and development. Discussion of case studies. Feasibility and locational analysis.

3. Planning And Forecasting:

Role of market survey and market research in pre-planning, long medium and short range forecasting, objective and techniques of forecasting, smoothening and revision of forecast

4. Production Planning:

Production planning objective and functions, Bill of material, Capacity and man power requirement planning, operation analysis and process planning, long range planning, aggregate planning; Objective, Strategies, graphical and mathematical techniques of aggregate planning, master production scheduling, MRP and MRPII Systems

5. Production Control:

Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems.

6. Material Management:

Objectives, scope and functions of material management, planning, procurement, storing, ending and inventory control. Purpose of inventory, inventory cost, inventory control systems, Selective inventory control systems, Determination of EOQ, Lead time and reorder point. Methods of physical stock control.

7. Quality Control:

Meaning of quality and quality control, quality of design, quality of conformance and quality of performance, functions of quality control. Introduction to statistical quality control-control charts and sampling plans.

8. Management Information Systems:

Introduction to MIS, Steps in designing MIS, Role of Computers in MIS.

9. Maintenance Systems:

Type of maintenance, objective of maintenance, Planned maintenance strategies, preventive maintenance, condition monitoring and total productive maintenance

BOOKS:

1. S.N. Charry, Production and Operation Management, Tata-McGraw Hill.

2. J.G. Monks, Production/Operation Management, Tata-McGraw Hill.

3. R.N. Nauhria and Rajnish Prakash, Management of systems, Wheeler Publishing.

4. Elwood S. Buffa, Modern Production Management, John Wiley.

5. E. L. Grant and R.S. Leaven Worth, Statistical Quality Control, McGraw Hill.

DE/ME-2.4 NON-DESTRUCTIVE TESTING

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Classification of techniques of material testing, Need and Significance of Non Destructive Testing methods, type of Non Destructive testing methods.

2. Radiographic Examination:

Radiant energy and radiography, practical applications, X-ray and Gamma –ray equipment, effect of variables on radiographs, requirement of a good radiograph, interpretation of radiograph, safety precautions, Xeroradiography.

3. Magnaflux methods:

Basic principles, scope and applications, magnetic analysis of steel bars and tubing magnetization methods, equipment, inspection medium, preparation of surfaces Fluorescent Penetration inspection, Demagnetization.

4. Electrical and ultrasonic Methods:

Basic principles, flaw detection in rails and tubes (Sperry Detector), Ultrasonic testing surface roughness, moisture in wood, Detection of defects in ferrous and non ferrous metals, plastics, ceramics, measurement of thickness, hardness, stiffness, sonic material analyzer, proof tests, concrete test hammer.

5. Photoelasticity:

Concept and applications of Plane and circular polarization, Photo stress, models.

Books

1. H.E. Davies, G.E Troxell and GFW Hauck, The testing of Engg materials, Mc Graw Hill.

2. W.H Armstrong, Mechanical Inspection, Mc Graw Hill.

DE/ME-2.5 TOTAL QUALITY MANAGEMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Quality and Total Quality Management:

Excellence in manufacturing/service, factors of excellence, relevance of TQM.

2. Concept and definition of quality:

Total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models, benefits of TQM.

3. Just-in-time (JIT):

Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

4. Customer:

Satisfaction, data collection and complaint, redressal mechanism.

5. Planning Process:

Policy development and implementation; plan formulation and implementation.

5.Process Management:

Factors affecting process management, Quality function development (QFD), and quality assurance system.

7. Total Employees Involvement (TEI):

Empowering employees: team building; quality circles; reward and Recognition; education and training, Suggestion schemes.

8. Problems solving:

Defining problem, Problem identification and solving process, QC tools.

9. Benchmarking:

Definition, concept, process and types of benchmarking.

10. Quality Systems:

Concept of quality system standards: relevance and origin of ISO 9000; Benefits; Elements of ISO 9001, ISO 9002, ISO 9003.

11. Advanced techniques of TQM:

Design of experiments: failure mode effect analysis: Taguchi methods.

BOOKS:

1. Sunder Raju, Total Quality Management , Tata McGraw Hill.

2. M.Zairi, TQM for engineers, Aditya Books.

3. J.L. Hradeskym, Total Quality Management Handbook, McGraw Hill.

4. Dalela and Saurabh, ISO 9000 quality System, Standard Publishers.

DE/ME-2.6 MAINTENANCE AND RELIABILITY ENGINEERING

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Objective and characteristics of maintenance function, Organization of the maintenance system, Operating practices in maintenance, Maintenance record keeping.

2. Cost Aspect of Maintenance:

Costs of machine breakdown, estimation of life cycle costs, Application of work measurement in maintenance, Manpower planning and training, Incentive payments for maintenance.

3. Planning of Maintenance Activities:

Evaluation of alternative maintenance policies breakdown, preventive and predictive maintenance, fault diagnosis and condition monitoring techniques, simulation of alternative

practices, Development of preventive maintenance schedule, House keeping practices, total productive maintenance.

4. Maintenance Engineering:

Maintenance requirements of mechanical, electrical, process and service equipment, Safety aspect in maintenance, Aspect of lubrication; chemical control of corrosion, Computerized maintenance information systems.

5. Reliability:

Concept and definition, configuration of failure data, various terms used in failure data analysis in mathematical forms, component and system failures, uses of reliability concepts in design and maintenance of different system.

6. Reliability and Availability of Engineering systems:

Quantitative estimation of reliability of parts, Reliability of parallel and series elements, Accuracy and confidence of reliability estimation, Statistical estimation of reliability indices, Machine failure pattern, Breakdown time distribution.

7. Reliability improvement:

Reliability in design, reliability in engineering, systems, systems with spares, reliability simulation, redundant and stand by systems, confidence levels, component improvement element, unit and standby redundancy optimization and reliability-cost trade off.

8. Fault Tree Analysis:

Introduction and importance, fault tree construction, reliability calculations from fault tree, tie set and cut set methods, event tree and numerical problems.

Books

1. Lindley R. Higgins, Maintenance Engineering Handbook, McGraw Hill.

2. R.H. Clifton, Principles of Planned Maintenance, Edward Arnold.

3. A Kelly, Maintenance Planning control, McGraw Hill.

4. L.S Srinath, Reliability Engineering, East West Press.

5. S.K. Sinha, Reliability Engineering, John Wiley.

DE/ME-2.7 MATERIAL MANAGEMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Meaning, definition, functions of materials management, Concept of integrated material management, Relationship of material management with other Organizational functions.

2. Material Planning & Budgeting:

Need for material planning, Factors affecting material planning, Techniques of material planning, Material classification, codification and standardization, Material budgeting - meaning and need, techniques of material budgeting.

3. Inventory Control:

Need and meaning of inventory, types of inventory, functions of inventory control, Inventory costs, Inventory control tool - ABC, VED, XYZ and FSN: Economic order Quantity and replenishment of stocks. Physical control of inventory: Fixed order, Two bin and Kardex systems - Material requirement planning (MRP-I) Spare parts control for maintenance purposes. Evaluation of inventory control performance. Concept of Just-in-Time(JIT). Use of computers for inventory control

4. Purchasing:

Purchasing principles, procedures and systems, Functions of purchasing, Make-or-buy decision, Vendor development and vendor rating. Factors affecting purchase decisions, Legal aspects of purchasing, Documentation and procedure for import.

5.Storage:

Functions and importance of store keeping, types of stores, store accounting and store verification, Legal aspects of store keeping, Management of surplus, scrap and obsolete items. Importance of material handling in store keeping, handling equipment.

Books

1. M.M. Verma, Materials Management, S. Chand and Co.

2. Gopal Krishnan and Sundaresan, Material Management - An Integrated Approach, Prentice Hall

3. Dobbler and Burt, Purchasing and materials management, Tata McGraw Hill

4. M. Starr and D. Miller, Inventory control, Prentice Hall.

DE/ME-2.8 MANAGEMENT INFORMATION SYSTEM

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Information and Decision Making:

Concept of information; data versus information, characteristics of information, classification of information, cost and value of information, Use of information in the decision making process, information requirements for decision making, types of decisions, decision making process, decision making models role of information system, decision support systems, expert systems.

2. Management Information Systems (MIS):

Concept, Characteristics and importance of management information systems, types of information systems role of computers in management information systems, hierarchy of data processing systems, operating elements of MIS, information needs of MIS, storage and retrieval of data processing, functions of information systems, management reports. Analysis and design cycle for MIS. Various approaches to system analysis and design. Strategic and project Planning for MIS, analysis and design, matching mission, objectives and plans of MIS with business plans, project planning for MIS, Conceptual system design, Detailed system design, Implementation, Evaluation and Maintenance of MIS.

3. Computer Networks and Data Communication Computer network:

Local Area networks; characteristics topologies network structures, switching networks, OSI standards for multi vendor network. I.A.N standards, application of networks, Data Communication concepts, types and modes of transmission, hardware requirements, communication controllers, Data Communication software, data communication protocol.

4. Data Base Management Systems:

Introduction, data base designing, relational data base management system. Introduction to computerized data base management system.

Books

1. Robert G. Mudrick, Joel E. Ross and James R. Clagget, Information System for Modern Management, Prentice Hall.

2. G. Davis and M. Olson, Management Information systems, McGraw Hill

3. Henry C. Lucas, Information systems for management, McGraw Hill.

DE/ME-2.9 ENTREPRENEURSHIP

Internal Marks: 40 External Marks: 60 Total Marks: 100

1.Concept of Entrepreneurship:

Entrepreneurship and small scale industry, need for promotion of entrepreneurship, entrepreneurship development programmes (EDP), personality characteristics of entrepreneur.

2. Identification of Investment Opportunities:

Governmental regulatory framework, industrial policy, industrial development and regulation act, regulation of foreign collaboration and investment, foreign exchange regulation act, incentives for export oriented units, incentives for units in industrially backward areas, incentives for small scale industry, government assistance to SSI, how to start and SSI, list of items reserved for SSI, Scouting for project ideas, preliminary screening, project identification for an existing company.

3. Market and Demand Analysis:

Information required for market and demand analysis, market survey, demand forecasting, uncertainties demand forecasting.

4. Cost of Project and Means of Financing:

Cost of project, means of financing, planning the capital structure of a new company, term loan financial institutions, cost of production.

5. Financial Management:

Concept and definition of financial management types of capital, of finance, reserve and surplus, concepts and liabilities, profit and loss statement balance sheet, depreciation, methods of calculating depreciation break even analysis.

Books:

1. E.D.I. Ahmedabad, Publication regarding Entrepreneurship.

2. Prasanna Chandra, Project Preparation, Appraisal Budgeting and Implementation, McGraw Hill. .

4. C.S.Gupta and N.P.Srinivasan, Entrepreneurial Development, S. Chand and co.

5. S. S. Khanka, Entrepreneurship Development Practice and Planning, S. Chand and co.

Group-III

DE/PE-3.0 PRODUCT DESIGN AND DEVLOPMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Visual Design:

Basic elements and concept of visual design-line color, Balance proportion, Size shape mass, unity and variety, Special relationships and composition in two and three dimensions.

2. Form and Color:

Elementary forms their characteristics and significance in design. Form transition, Form in relation to ergonomics, material and manufacturing process, color as an element of design, color clarification dynamics, interrelation of colors, colors and traditions; Psychological use of color form and material.

3. Product Graphics:

Meaning and objectives of product graphics. Basic principles of graphic design, Visual communication aspects of product graphics, Graphics of displays and control panels,

4. Product Detailing:

Standard fastening and joining details in different materials; Temporary and permanent joints: Detailing for plastic products, Detailing for fabricated products in sheet metal.

5. Products Development:

Definition and objective, Role of designer in product development. Manufacturing and economic aspects of product development, Product promotions, product developments.

BOOKS:

1. W.H. Mayal, Industrial Design for Engineers, London Liifee Books Ltd.

2. Huchingson R. Dale, New Horizons for Human Factors in Design, McGraw Hill.

3. N.L. Svensson, Engineering Design.

4. R. Matousek, Engineering Design.

5. K. J. Mccormick (Ed), Human Factor Engineering, McGraw Hill.

DE/PE-3.1 MACHINE TOOL DESIGN

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

General requirements to machine tools, Machine tool design recommendations, Classification of motions to shape surface, Machine tool drives for rectilinear motion, Periodic motion, reversing motion etc.

2. Kinematics of Machine Tools:

Kinematics or gearing diagram of Lathe, drilling Machine, Milling Machine etc. Main. drive and feed drive, principles specification of Machine tool.

3. Design of Kinematics Scheme:

Methods to determine transmission ratios for drives,. Development of Kinematics scheme, minimum of transmission groups, Determination of number of teeth on gears.

4. Speed and Feed Boxes:

General requirement Design of gear trains, speed boxes types, speed changing devices, Feed boxes characteristics of feed mechanism, types of Rapid traverse mechanisms, variable devices.

5. Spindle Design and Spindle Bearings:

Main requirement, Materials and details of spindle design, Spindle bearings, bearings, types of bearings and their selections, Bearing Materials BED,

6. Columns, Tables and Ways:

Materials, typical constructions and design.

7. Machine Tools Control Systems:

Requirement of control system selection and construction of control systems Mechanical control system, predilection control, remote control safety devices.

8. Machine Tool Dynamics:

Dynamic performance, dynamic and elastic system of Machine, tools. Dynamics of cutting forces, tool chatter.

Books:

1. Sen and Bhattacharya, Machine Tools Design, CBS Publishers.

2. N.K. Mehta, Machine Tool Design, Tata McGraw Hill.

3, N. Acherkan, Machine Tool Design, Four Volumes, Mir Publishers.

5. S.K. Basu and D.K. Pal, Design of machine tools, Oxford and IBH.

DE/PE-3.1 OPTIMIZATION TECHNIQUES

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction : Origin of OR and its role in solving industrial problems : Generalapproach for solving OR problems. Classification of mathematical models: variousdecision making environments.

2. Linear Programming: Formulation of linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis.

3. Transportation and Assignment Models: Various initial basic feasible solutions methods, Optimization of transportation and assignment using different methods considering the concept of time and cost function.

4. Dynamic Programming: Introduction to deterministic and probabilistic dynamic programming.

5. Queuing Theory: Types of queuing situation: Queuing models with Poisson's inputand exponential service, their application to simple situations.

6. Replacement Models: Replacement of items that deteriorate, Replacement ofitems whose maintenance and repair costs increase with time, replacement of itemsthat fail suddenly;

replacement of items whose maintenance costs increase with timeand value of money also changes, individual replacement policy, group replacement policy.

7. Network models: Shortest route and traveling sales - man problems, PERT &CPM introduction, analysis of time bound project situations, construction of net works,identification of critical path, slack and float, crashing of network for cost reduction.

8. Non-linear Programming Models: Introduction to non-linear programming models. Problems related to the topic.

BOOKS:

1. H.M Wagner, Principles of Operations Research, Prentice Hall.

2. P.K. Gupta and D.S. Hira, Operations Research, S. Chand & Co.

3. F.S. Hiller and G.I. Libermann, Introduction to Operation Research, Holden Ray.

4. A Management Guide to PERT/CPM Wiest & Levy Prentice Hall

DE/ME-3.3 TOOL DESIGN

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Process Planning:

Product Engineering, Process Engineering, Definition of Process Planning, Contents of Process Plan, Process Operations, Steps of Process Planning, Process Planning Sheet, Planning and Tooling for Low Cost Planning.

2. Jigs and Fixture:

Principles of jig and fixture design, Principle of degrees of freedoms, methods of locations and clamping, Various devices for location and clamping, indexing devices, Hydraulic and pneumatic actuation of clamping devices, jig bushes, use of standard parts of jig design, type of drilling jigs, milling fixtures, lathe fixture, grinding fixtures and their classification.

3. Die Design:

Components of die design, design of die blocks, punches and strippers, methods of holding punches, sketches of stock stops, Design procedure for progressive dies, compound dies and combination dies for press tool operation forging die design for drop and machine forging parts.

4. Tool Layout for Turrets:

Characteristics of Turret lathes, Differences between capstan and turret lathes, methods of holding jobs on the Turret lathe, Universal chucking equipment, universal bar equipment, operation sheet and tool layout.

5. Tool Layout for Automatics:

Classification of Automatics, Turret type automatic, tool layout procedure, time required for each operation, operation sheet, tool layout, cam layout.

6. Tooling Costs:

Estimating cost of a product, estimating costs of tools, Economics of tooling, Break even point analysis, minimum cost analysis.

7. Gauges:

Limits and fits, Plain Gauges, types of Gauges, fundamentals of Gauge Design, Gauge makers tolerance, allowance for wear, Practical application of Taylor's principles of limit gauging, care of Gauges, Limitation of Limit Gauging.

8. Surface Finish:

Elements of surface finish, Factors affecting surface finish, Effect of surface quality on Functional properties of machine parts, Evaluation of surface finish, Indian Standards on surface finish. Measurement of surface finish, Relationship of surface finish to the production methods. Finishing operations like honing, lapping, buffing super finishing etc.

Books:

1. Cole: Tool Design.

2. C. Donaldson, Tool Design, Mc Graw Hill

3. ASTM, Fundamentals of Tool Design.

4. P.C.Sharma, A Textbook of Production Engineering, S.Chand Publication.

DE/ME-3.4 FINITE ELEMENT METHOD

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

General description of the method summary of the analysis procedure

2. Discretisation of the domain:

Type of elements, location of nodes, number of elements, simplification on offered by physical configuration of body, node numbering scheme.

3. One and Two Dimensional Problems:

Introduction, coordinates and shape functions, Potential energy approach, Galerkin Approach, Assembly of the global stiffness matrix and load vector , FEM equations and treatment of boundary conditions, quadratic shape functions, Two dimensional problems using constant strain triangles

4. Axisymmetric solids subjected to axisymmetric loadings:

Axisymmetric formulation, FEM using triangular element, problem using boundary conditions.

5. Static analysis:

Plain and three Dimensional Trusses, Assembly of global matrix for the banded and skyline solutions, Beams and frames in various different conditions.

6. Dynamic Analysis:

Dynamic equation of motion, consistent mass matrix for truss element frame element and triangular plate element, evaluation of eigen values and eigen vectors.

7. Solution of finite element equations:

Direct integration methods, central difference method, Houbolt method, Wilson method, Newmark method, mode superposition method,

Books:

1. Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall.

2. Chandrupatla and Belegundu, Introduction to Finite Element in Engineering, Prentice Hall.

3. Cook, Concepts and Applications of Finite Element Analysis, John wiley.

DE/ME-3.5 EXPERIMENTAL STRESS ANALYSIS

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Basic Elasticity:

Laws of stress transformation, principal stresses and principal planes, Cauchy's stress quadric strain analysis, strain equations of transformation, Cauchy's strain quadric, stress, strain relationship.

2. Two Dimensional Photoelasticity:

Stress optics law, Optics of polarisation plane and circular polariscope, dark and light field arrangements, fringe multiplication, fringe sharp ending, compensation techniques, commonly employed photo elastic materials.

3. Dimensional Photoelasticity:

Neuman's strain optic relationship, stress freezing in model materials for three dimensional photoelasticity, shear difference method for stress separation.

4. Birefringence Coatings:

Sensitivity, reinforcing effects, thickness of birefringence coatings.

5. Electric Resistance Strain Gauges:

Gauge construction and installation, temperature compensation, gauge sensitivities, gauge factor, corrections for transverse strain effects, factors affective gauge relation, rosetters Rosetre analysis, potentiometer and whetstone's bridge circuits for strain measurements.

6. Brittle Coatings:

Introduction, coating stresses and failure theories, different types of crack patterns, crack detection composition of brittle coatings, coating cure, influence of atmospheric conditions, effects of biaxial stress field.

Books:

1. Dally and Rilley, Experimental Stress Analysis, McGraw Hill.

2. Dow and Adams, Experimental Stress Analysis and Motion Measurement, Prentice Hall.

3. Durelly and Riley, Introduction to Photo Mechanics, Prentice Hall.

DE/ME-3.6 INDUSTRIAL TRIBOLOGY

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Tribological considerations, Nature of surfaces and their contact, Physic mechanical properties of surface layer Geometrical properties of surfaces, methods of studying surfaces, Study of contract of smoothly and rough surfaces.

2. Friction and Wear:

Role of friction and laws of static friction, causes of friction , adhesion theory, Laws of rolling friction, Friction of metals and non-metals; Friction measurements. Definition of wear, mechanism of wear, friction affecting wear, wear measurement, Wear of metals and non-metals.

3. Lubrication and Lubricants:

Introduction, dry friction, Boundary lubrication, classic hydrodynamics, hydrostatic and elasto hydrodynamic lubrication, Functions of lubricants, Types of lubricants and their industrial uses, properties of liquid and grease lubricants; lubricant additives , general properties and selection.

4. Special Topics:

Selection of bearing and lubricant, bearing maintenance, diagnostic maintenance of tribological components, lubrication systems, Filters and filtration.

Books:

1. O'Conner and Royle, Standard Hand Book of Lubrication Engg., McGraw Hill.

2. Halling and Wykeham, Introduction to Tribology, Publications Ltd.

3. Raymono O.Gunther, Lubrication, Bailey Bros and Swinfan Ltd.

4. PT Barwll, Rearing Systems, Principles and Practice,Oxford press.

5. A Cameron, Basic Lubrication Theory, Wiley (Indian Edition).

DE/ME-3.7 THEORY OF PLASTICITY

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction to Plasticity:

Idealized stress-strain systems, approximate equation for stress strain curves (Ramberg-Osgood, Ludwig's and Karunes equations), Bauschinger effect-yield locus, yield surface.

2. Yield Criteria and Flow Rules:

Tresca theory & Von-Mises yield criterion, their geometrical representation, experimental evidence for the criteria.

3. Slip Line Field Theory:

Two-dimensional plasticity, slip lines, basic equations, Hencjy's first theorem, Geiringer's Velocity equation, Applications of slip line field theory to plane strain problems.

4. Load Bounding:

The lower bound theorem, the upper bound theorem and their corollaries. Application of load bounding to plane strain problems.

Books

1. Johanson and Miller, Plasticity for mechanical Engineers, Van Nostrand.

2. Calladina, Engg Plasticity, Pergmean Press.

DE/ME-3.8 MECHATRONICS

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction to Mechatronics:

Definition and approach of Mechatronics, Measurement and Control Systems, Microprocessor based controllers and Mechatronics Approach.

2. Sensors and Transducers:

Performance Terminology, Displacement, velocity, Position, Proximity, force, fluid pressure, liquid level, temperature, light sensors, procedure for selection.

3. Signal Conditioning:

Op Amp, Protection, digital signals, Multiplexes and digital signal processing, pulse modulation

4. Pneumatic and Hydraulic Systems:

Actuation systems, Directions, pressure and process control valve, Pneumatic and hydraulic systems

5. Electrical Actuation System:

Mechanical Switches, Solid State Switches, Solenoid, DC/AC Motors, Stepper Motors

6. Microprocessor and Its Application:

Architecture of Microprocssor 8085, Instruction set, Embedding a microprocessor into a Mechatronics system.

7. Microprocessor Based Project:

Assemble a suitable system using microprocessor kit for its control.

Books:

1. W. Bolton, Mechatronics, Pearson Education.

2. Rafiquzzaman, Microprocessors.

3. S. Boennett, Real time computer controls, Prentice Hall.

4. Benjamin C. Kuo, Automatic Control Systems, Prentice Hall.