MECHANICAL ENGINEERING

PAPER I
(Choose Any ONE Subject)

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1	ADVANCED MECHANICS OF SOLIDS	10ME101
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PAPER-II
(Choose any ONE subject)

S.No	Sub Name	Sub Code
1	COMPUTATION FLUID DYNAMICS	10ME201
2	CAD THEORY AND PRACTICE	10ME202
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5	ADVANCED OPTIMIZATION TECHNIQUES	10ME205
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7	DESIGN OF HEAT TRANSFER EQUIPMENT	10ME207
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9	I.C ENGINES & ALTERNATE FUELS	10ME209
10	INTELLIGENT MANUFACTURING SYSTEMS	10ME210
11	LOGISTICS AND SUPPLY CHAIN MANAGEMENT	10ME211
12	SIMULATION AND MODELLING	10ME212
13	SPECIAL MANUFACTURING PROCESSES	10ME213
14	PRODUCTION AND OPERATIONS MANAGEMENT	10ME214
15	ROBOTICS	10ME215

Subject Code : 10ME101

ADVANCED MECHANICS OF SOLIDS

Unit I

Shear center: Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections

Unit II

Unsymmetrical bending: Bending stresses in Beams subjected to Nonsymmetrical bending; Deflection of straight beams due to nonsymmetrical bending.

Unit III

Curved beam theory: Winkler Bach formula for circumferential stress - Limitations - Correction factors -Radial stress in curved beams - closed ring subjected to concentrated and uniform loads-stresses in chain links.

Unit IV

Torsion : Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section ;Hollow thin wall torsion members ,Multiply connected Cross Section.

Unit V

Contact stresses: Introduction; problem of determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area.

Unit VI

Two Dimensional Elasticity Problems: Plane stress & Plain strain-Problems in Rectangular Co-ordinates, bending of cantilever loaded at the end, bending of a beam by uniform load.

Unit VII

Two Dimensional Elasticity Problems: in polar co-ordinators, general equations in polar coordinates, stress distribution symmetrical about an axis, pure bending of curved bars, displacements for symmetrical stress distributions, rotating discs.

Unit VIII

Introduction to Three Dimensional Problems: Uniform stress stretching of a prismatical bar by its own weight, twist of circular shafts of constant cross section, pure bending of plates.

Reference book:

1.Advanced Mechanics of materials by Boresi & Sidebottom-Wiely International.

2. Theory of elasticity by Timoschenko S.P. and Goodier J.N. McGraw-Hill Publishers

3. Advanced strength of materials by Den Hortog J.P.

4. Theory of plates - Timoshenko.

5. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia

Subject Code : 10ME102

FINITE ELEMENT METHOD

UNIT - I Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements, Variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions.

UNIT - II One-dimensional finite element methods: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin,

UNIT - III Trusses: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects.

UNIT - IV Beams and Frames: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT - V Two dimensional problems: CST, LST, four noded and eight nodded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin.

UNIT - VI Isoparametric formulation: Concepts, sub parametric, super parametric elements, numerical integration.

UNIT - VII Finite elements in Structural Dynamics: Dynamic equations, eigen value problems, and their solution methods, simple problems.

UNIT - VIII Convergence: Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, pascal's triangle.

Reference B o o k s:

1. Finite element methods by Chandrubatla & Belagondu.
2. J.N. Reddy, Finite element method in Heat transfer and fluid dynamics, CRC press
3. Zienckiwicz O.C. & R. L. Taylor, Finite Element Method, McGraw-Hill
4. J. N. Oden, Finite Element of Nonlinear continua, McGraw-Hill, New York
5. K. J. Bathe, Finite element procedures, Prentice-Hall

Subject Code : 10ME103

MATERIAL TECHNOLOGY

UNIT I :
Elasticity in metals and polymers, mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening

UNIT II :
Poly phase mixture, precipitation, particle, fiber and dispersion strengthening, effect of temperature, strain and strain rate on plastic behavior, super plasticity, deformation of non crystalline material.

UNIT III :
Griffth's Theory, stress intensity factor and fracture Toughness, Toughening Mechanisms, Ductile and Brittle transition in steel, High Temperature Fracture, Creep, Larson : Miller Parameter, Deformation and Fracture mechanism maps.

UNIT IV :
Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and Paris Law, Effect of surface and metallurgical parameters on Fatigue, Fracture of non:metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis.

UNIT V :
Motivation for selection, cost basis and service requirements, Selection for Mechanical Properties, Strength, Toughness, Fatigue and Creep.

UNIT VI :
Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing, Case studies in Materials Selection with relevance to Aero, Auto, Marine, Machinery and Nuclear Applications.

UNIT VII :
MODERN METALLIC MATERIALS : Dual Phase Steels, Micro alloyed, High Strength Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP) Steel, Maraging Steel, Intermetallics, Ni and Ti Aluminides, Smart Materials, Shape Memory alloys, Metallic Glass, Quasi Crystal and Nano Crystalline Materials.

UNIT VIII :
NONMETALLIC MATERIALS : Polymeric materials and their molecular structures, Production Techniques for Fibers, Foams, Adhesives and Coatings, Structure, Properties and Applications of engineering Polymers, Advanced Structural Ceramics WC, TiC, TaC, Al2 O3, SiC, Si3 N4 , CBN and Diamond : properties, Processing and applications.

TEXT BOOKS:

1. Mechanical Behaviour of Materials / Thomas H. Courtney, McGraw Hill.
2. Mechanical Metallurgy / George E. Dieter / McGraw Hill.
3. Selection and use of Engineering Materials /Charles J.A/ Butterworth Heiremann.

Subject Code : 10ME104

MECHANICS OF COMPOSITE MATERIALS

Unit - I Basic concepts and characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites,

Unit - II Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

Unit – III Micromechanics: Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

Unit - IV Coordinate transformations: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress - strain relations. Off - axis, stiffness modulus, off - axis compliance.

Unit - V Elastic behavior of unidirectional composites: Elastic constants of lamina, relation ship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

Unit - VI Strength of unidirectional lamina: Micro mechanics of failure, Failure mechanisms, Strength of an orthotropic lamina, Strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micro mechanical predictions of elastic constants.

Unit - VII Analysis of laminated composite plates

Introduction, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

Unit - VIII Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

Reference Books:

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York.
2. Engineering Mechanics of Composite Materials by Isaac and M.Daniel, Oxford University Press.
3. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York.
4. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York.

Subject Code : 10ME105

NON - DESTRUCTIVE EVALUATION

Unit - I Ultra Sonic Hardness Testing: Flaw Detection Using Dye Penetrants. Magnetic Particle Inspection introduction to electrical impedance, Principles of Eddy Current testing, Flaw detection using eddy currents.

Unit - II Introduction to X-Ray Radiography: The Radiographic process, X-Ray and Gamma-ray sources, Geometric Principles, Factors Governing Exposure, Radio graphic screens, Scattered radiation, Arithmetic of exposure, Radiographic image quality and detail visibility, Industrial X-Ray films,

Unit - III X-Ray Radiography processes: Fundamentals of processing techniques, Process control, The processing Room, Special Processing techniques, Paper Radiography, Sensitometric characteristics of x-ray films, Film graininess signal to noise ratio in radiographs, The photographic latent image, Radiation Protection,

Unit - IV Introduction to Ultrasonic Testing: Generation of ultrasonic waves, Horizontal and shear waves, Near field and far field acoustic wave description, Ultrasonic probesstraight beam, direct contact type, Angle beam, Transmission/reflection type, and delay line transducers, acoustic coupling and media,

Unit - V Ultrasonic tests: Transmission and pulse echo methods, A-scan, B-scan, C-scan, F-scan and P-scan modes, Flaw sizing in ultrasonic inspection: AVG, Amplitude, Transmission, TOFD, Satellite pulse, Multi-modal transducer, Zonal method using focused beam. Flow location methods, Signal processing in Ultrasonic NDT; Mimics, spurious echos and noise. Ultrasonic flaw evaluation.

Unit - VI Holography: Principles and practices of Optical holography, acoustical, microwave, x-ray and electron beam holography techniques.

Unit - VII Applications - I: NDT in flaw analysis of Pressure vessels, piping

Unit - VIII Applications - II: NDT in Castings, Welded constructions, etc., Case studies.

Text books:

1. Ultrasonic testing by Krautkramer and Krautkramer

2. Ultrasonic inspection & Training for NDT : E. A. Gingel, Prometheus Press,

3. ASTM Standards, Vol 3.01, Metals and alloys

Subject Code : 10ME106

FUELS, COMBUSTION AND ENVIRONMENTAL POLLUTION CONTROL

UNIT I: Fuels:- Detailed classification-Conventional and unconventional, solid, liquid, gaseous fuels - Coal-carbonization, Gasification and liquefaction - Lignite; Petroleum based fuels-problems associated with low calorific value gases.

UNIT II: Coal gas, Blast furnace gas, Alcohols, Biogas and Nuclear fuels.

UNIT III: Principles of Combustion:- Chemical kinetics - Adiabatic flame temperature - Laminar and turbulent flame propagation and structure - Flame stability - Combustion of fuel droplets and sprays - Combustion systems - pulverized fuel furnaces - Fixed, entrained and fluidized bed systems.

UNIT IV:
Environmental considerations:- Air pollution - Effects on environment, human health, etc., Principal pollutants - Legislative measures - Methods of emission control.

UNIT IV: Environmental segments, Natural cycles of environment, Atmospheric structure, Green house effect, Ozone hole, Effect of pollution on living systems, Minimum national standards.

UNIT V: AIR POLLUTION -Sources and classification of pollutants, Effect of air pollution, Pollution from industries, Chemical reactions in a contaminated atmosphere, urban air pollution, Acid rain, Photo chemical smog, Meteorological aspects of air pollution. Air pollution sampling and measurement, Air pollution control methods and equipment.

UNIT IV: WATER POLLUTION AND CONTROL - Origin of waste water, Types of water pollutants and their effects ,Water pollution laws and standards Waste water sampling and analysis , Treatment of waste water.

UNIT VII: SOLID WASTE MANAGEMENT - Sources and classification, Public health aspects, methods of collection, Disposal methods, Potential methods of disposal.

UNIT VIII: NOISE POLLUTION - Human acoustics, Sound and its general features, Noise and its measurement, Noise pollution hazards & Controlling methods.

Textbooks:

1. Combustion Fundamentals by Roger A. Strehlow - Mc.Graw Hill
2. Fuels and Combustion by Sharma and Chander Mohan - Tata Mc.Graw Hill.
3. Combustion Engineering and fuel Technology by Shaha A.K. - Oxford and IBH.
4. Principles of Combustion by Kenneth K. Kou - wiley & Sons.
5. Pollution control in process industries - S.P. Mahajan/Tata Mc Graw Hill
6. Environmental pollution control engineering - C.S.Rao/New age Int. Pvt.Ltd
7. Air pollution - M.N.Rao and M.V.N.Rao /Tata Mc Graw Hill
8. Energy Technology - S.Rao and B.B.Parulekar /Khanna publishers

Subject Code : 10ME107

CONVECTIVE HEAT & MASS TRANSFER.

CONVECTIVE HEAT TRANSFER:

1. Introduction to convection, review of conservation equations - Forced convection in laminar flow - Exact and approximate solutions of Boundary layer energy equation for plane isothermal plate in longitudinal flow - problems.

2. Forced convection heat transfer in laminar tube flow - forced convection in turbulent flow - Internal Flows-Correlations-Problems.

3. Approximate analysis of laminar free convective heat transfer on a vertical plate-external flows-correlations-problems.

4. Boiling and condensation: Analysis of film condensation on a vertical surface - pool boiling - forced convection boiling inside tubes - problems.

MASS TRANSFER:

5. Definitions of concentration and velocities relevant to mass transfer, Fick's law, species conservation equation in different forms.

6. Steady state diffusion in dilute solutions in stationary media, transient diffusion in dilute solutions in stationary media, one dimensional non dilute diffusion in gases with one component stationary.

7. Convective mass transfer - governing equations-forced diffusion from flat plate-Dimension less correlation's for mass transfer.

8. Simultaneous heat and mass transfer - analogy between heat, mass and momentum transfer.

REFERENCES BOOKS:

1. Heat transfer - J. P. Holman.
2. Heat and Mass transfer- R.C. Sachdeva
3. Convective Heat and Mass transfer-Kays.
4. Heat and Mass transfer - V.Gupta and I.Srinivasan - Tata Mc.Graw Hill

Subject Code : 10ME108

NON-CONVENTIONAL SOURCES OF ENERGY

1. **SOLAR ENERGY:** Availability of solar energy, Measurement of sunshine, solar radiation data, estimation of average solar radiation, the black body, absorptance and emittance, Kirchoff's law. Reflection from surfaces, Solar energy selection, selective surfaces, Construction of solar flat plate and evacuated tube collectors, Performance of solar energy collectors, Solar heating and cooling.

2. **WIND ENERGY:** wind mills and wind turbine systems, Classification of wind machines: Horizontal & Vertical axis configuration. High and low solidity rotors, Elements of wind mills and wind turbine systems, Aerodynamic models, Rankine Froud Actuator disc model, Betz limit, angular momentum wake rotation theory, Aerofoil sections and their characteristics, Estimation of power output and energy production - gust parameters.

3. **OCEAN THERMAL ENERGY:** Ocean thermal energy sources, Ocean thermal energy power plant development, Closed and open cycles. Advantages and operating difficulties.

4. **TIDAL & WAVE ENERGY:** Tidal power sources, Conventional and latest design of tidal power system, The ocean wave, Oscillating water column (Japanese) and the Dam, Atol design.

5. **GEOTHERMAL ENERGY:** Earth as source of heat energy, stored heat and renewability of earth's heat, Nature and occurrence of geo thermal field, Classification of thermal fields, Model of Hyper thermal ields & Semi thermal fields, Aims of exploration, drilling hot water measurements, Heat & Power capacity of a bore.

6. **FUEL CELL ENERGY:** Description, properties and operation of fuel cells, Major components & general characteristics of fuel cells, Description of low power fuel cell systems, portable fuel cell systems. Indirect methanol fuel cell systems. Phosphoric acid fuel cell systems and molten carbonate fuel cell systems.

7. **PHOTO VOLTAIC ENERGY:** solar cells. Photovoltaic conversion efficiency, Performance characteristics of solar cells as a function of light intensity, temperature and cell area, Solar cell response under normal condition, solar cell arrays, energy calculation of solar cells, Methods of concentration.

8. **BIOMASS ENERGY:** Types of conversion techniques for the production of solid, liquid and gaseous fuels by chemical and biochemical methods - Technology of bio-gas, - Principles and feed stock Design of bio-gas plants - Biomass gasifiers- Selection of a model and size, Technical, Climatic, geographical and economic issues.

BOOKS:

1. Principles of Solar Engineering: F.Kreith&J.F.Krieder/Mc.Graw Hill Book Co
2. Wind Energy conversion Systems: L.C.Freris, Prentice Hall, Inc..
3. Geo thermal energy: H.Christopher&H.Armstead.
4. Photo Voltaic Energy Systems, Design&Applications: Mathew Buresch, Mc Graw Hill Book Co..
5. Bio Gas Technology - Practical Hand Book: K.C.Khendelwal&S.S.Mahdi McGrawHill Book Co..
6. Renewable Energy Sources & Conversion technology: Bansal.K: Leemann&Meliss

7. Energy technology Hand Book: EdD.M.Considine

Subject Code : 10ME109

ADVANCED THERMODYNAMICS

1. BASIC CONCEPTS: Thermodynamics - Temperature and zeroth law of thermodynamics - first law of thermodynamics - limitations of first law - concept of internal energy - second law of thermodynamics - concept of entropy.

2. THERMODYNAMIC RELATIONS : Introduction - Helmholtz free energy function - Gibbs free energy function - co-efficient of volumetric expansion - isothermal compressibility - differential relation for U, H, G & F - Maxwell relations.

3. GENERALIZED RELATIONS : Generalized relation for Cp, Cv, K and β - relations for internal energy and enthalpy -the various Tds equation - clapeyron equation - gas tables - enthalpy and internal energy - pressure ratio - volume ratio - change of entropy - Introduction to third law of thermodynamics.

4. EXERGY : Introduction - availability of heat - availability of a closed system - availability function of the closed system - availability of steady flow system - availability function of open system.

5. IRREVERSIBILITY : Introduction - irreversibility for closed and open system - steady flow process - effectiveness - second law analysis of the power plant.

6. NON RELATIVE GAS MIXTURES : Introduction - basic definitions for gas mixtures - PVT relations ship for mixtures of ideal gases - properties of mixtures of ideal gases - entropy change due to mixing - mixtures of perfect gases at different initial pressure and temperatures.

7. GAS POWER CYCLES: Introduction - air standard cycles - Carnot cycle - Otto cycle - diesel cycle - dual cycles - comparison between Otto, diesel, dual cycles - variations between the air standard Otto cycle and actual cycle - Sterling cycle - Erickson cycle - Atkinson cycle - Bray ton cycle - Lenoir cycle.

8. DIRECT ENERGY CONVERSION : Introduction - thermoelectric converters - thermo-ionic converters magneto hydrodynamics generators - solar power cells plant - fuel cells hydrogen - hydrogen fuel cells - direct and indirect oxidation fuel cells- biochemical fuels cells.

REFERENCE BOOKS:

1. Advanced Thermodynamics: Van Wyllan , TMGH
2. Engineering Thermodynamics: P.K.Nag, TMGH
3. Advanced Thermodynamics: Ray & Sarao, Central Publishers.

Subject Code : 10ME110

QUALITY ENGINEERING AND MANUFACTURING

UNIT-I

Quality value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design production processes.

UNIT-II

Loss function and quality level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances (N-type-, S-type and L-type)

UNIT-III

Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components.

UNIT-IV

Parameter and tolerance design: Introduction to parameter design, signal to noise ratios, parameter design strategy, Introduction to tolerance design, tolerance design using the loss function, identification of tolerance design factors.

UNIT-V

Design of Experiments: Introduction, Task aids and Responsibilites for DOE process steps, DOE process steps description.

Analysis of variance (ANOVA): no-WAY anova, One-way ANOVA, two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT-VI

Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, conducting and analyzing an experiment.

UNIT-VII

Interpolation of experimental results: Interpretation methods, percent contribution, estimating the mean

UNIT-VIII

ISO-9000 Quality system, BDRE,6-sigma, bench marking, quality circles-brain stormingfishbone diagram-problem analysis.

REFERENCE BOOKS:

1. Taguchi techniques for quality engineering/Philip J.Ross / McGraw Hill Intl. 2nd Edition.
2. Quality Engineering in Production systems/G.Taguchi, A.Elasayed et al/Mc.Graw Hill Intl. Edition.

3. Taguchi methods explained: Practical steps to Robust Design/Papan P.Bagchi/Prentice Hall Ind. Pvt. Ltd. New Delhi.

Subject Code : 10ME111

WORK STUDY AND IE PRACTICES

1. Introduction to work study - work study and its benefits.

2. Method study - Basis steps -selection and recording techniques charts and diagrams.

3. Work Measurement - Time study - Analytical estimation, activity sampling, predetermined time standards MTM, Synthetic standard data.

4. Principles of Motion Economy, Ergonomic design of tools and equipment.

5. Functions of Industrial Engineering I.E. Department in relation to other departments Organizing IE department.

6. Wage and salary administration - Job description - Job evaluation - job analysis incentives.

7. Planning, training methods, identification of training needs, designing and evaluation of training programmes.

8. Industrial accidents causation and prevention - Design of equipment and processes for safety - personnel protective equipment - Safety Inspection.

Reference Books

1. "Work Study" by H.O
2. Method Study" by Krish Pennather
3. "Motion and Time Study" by Harec, Ralph M
4. "Industrial Engineering Hand Book" by Maynard
5. "Industrial Health Engineering Hand Book"

Subject Code : 10ME112

COMPUTER INTEGRATED MANUFACTURING

1. Introduction: Fundamental concepts in Manufacturing and Automation, Automation Strategies, Economic analysis in production, fundamentals of CAD / CAM, product cycle and CAD/CAM,

2. Automation and CAD/CAM: Scope of CIM, Automated flow lines, Transfer mechanisms, methods of Line balancing.

3. Conventional Numerical control: Introduction- basic components of an NC system-the NC procedure- NC coordinate system, NC motion control system- application of numerical control-Economics of Numerical control.

4. NC part programming: Introduction - part programming methods - Computer assisted part programming, APT Language, macro statement in APT. NC programming with manual data input.

5. Computer controls in NC: NC controllers' technology - Computer Numerical Control (CNC), Direct Numerical control (DNC), Adaptive control machining systems: Adaptive control optimization, Adaptive control constraint.

6. Group Technology: Part families, parts classification and coding, production flow analysis, Composite part concept, Machine cell design, benefits of GT.

7. Flexible Manufacturing Systems: Components of FMS, FMS Work stations, Material Handling Systems, and Computer Control system, FMS layout configurations and benefits of FMS.

8. Computer aided planning systems: Approaches to Computer aided Process Planning (CAPP) - Generative and Retrieval CAPP systems, benefits of CAPP, Material Requirement Planning(MRP), mechanism of MRP, benefits, and Capacity Planning. Computer process control - Computer Process monitoring and control.

Text books:

1. CAD/CAM - Mikell P.Groover, and Emory W.Zimmers.Jr.

2.Automation,Production systems and Computer Integrated Manufacturing Systems - Mikel P.Groover.

3.CNC machines - Adithan and Pabla,New Age Publications

4. Computer Automated Manufacturing - David Bed Worth

5. Understanding CAD/CAM by DAVID J.Bowman

Subject Code : 10ME113

THEORY OF METAL CUTTING AND TOOL DESIGN

UNIT I:
Mechanics of Metal Cutting: Geometry of Metal Cutting Process, Chip formation, Chip Thickness ratio, radius of chip curvature, cutting speed, feed and depth of cut - Types of Chips, Chip breakers.

UNIT II:
Orthogonal and Oblique cutting processes-definition, Forces and energy calculations (Merchant's Analysis).- Power consumed - MRR - Effect of Cutting variables on Forces, Force measurement using Dynamometers.

UNIT III:
Single Point Cutting Tool: Various systems of specifications, single point cutting tool geometry and their inter-relation. Theories of formation of built-up edge and their effect, design of single point contact tools throwaway inserts.

UNIT IV:
Multipoint Cutting Tools: Drill geometry, design of drills, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speed & feed - machining time - design - from cutters.

UNIT V:
Grinding: Specifications of grinding of grinding wheel, mechanics of grinding, Effect of Grinding conditions on wheel wear and grinding ratio. Depth of cut, speed, machining time, temperature, power.

UNIT VI:
Tool Life and Tool Wear: Theories of tool wear-adhesion, abrasive and diffusion wear mechanisms, forms of wear, Tool life criteria and machinability index.

UNIT VII:
Types of sliding contact, real area of contact, laws of friction and nature of frictional force in metal cutting. Effect of Tool angle, Economics, cost analysis, mean co-efficient of friction.

UNIT VIII:
Cutting Temperature: Sources of heat in metal cutting, influence of metal conditions. Temperature distribution, zones, experimental techniques, analytical approach. Use of tool-work thermocouple for determination of temperature. Temperature distribution in Metal Cutting

REFERENCE BOOKS:

1. Metal Cutting Principles - M C Shaw / Oxford and IBH Publications, New Delhi
2. Fundamentals of Machining - Boothryd / Edward Amold publishers Ltd.
3. Metal cutting theory and cutting tool design -V. Arshinov and G. Alekseev / Mir Publishers, Moscow
4. Fundamentals of Metal cutting and Machine tools -B.L.Juneja, G. S. Sekhom and Nitin Seth / New Age International publishers

Subject Code : 10ME114

METAL FORMING PROCESSES

UNIT I:
Fundamentals of Metal Forming: Classification of forming processes, mechanism of metal forming, temperature of metal working, hot working, cold working, friction and lubricants.

UNIT II:
Rolling of metals: Rolling processes, forces and geometrical relationship in rolling, simplified analysis, rolling load, rolling variables, theories of cold and hot rolling, problems and defects in rolling, torque and power calculations.

UNIT III:
Forging: Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging.

UNIT IV:
Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, production of seamless pipes.

UNIT V:
Drawing: Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing.

UNIT VI:
Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, defect in formed parts.
Advanced Metal forming processes: HERF, Electromagnetic forming, residual stresses, inprocess heat treatment, computer applications in metal forming.

UNIT VII:
Press tool design: Design of various press tools and dies like piercing dies, blanking dies, compound dies and progressive blanking dies, design of bending, forming and drawing dies.

UNIT VIII:
Jigs and Fixture design: Principles of location, six-point location principle, clamping elements and methods.

Reference Books:

1. Mechanical Metallurgy / G.E. Dieter / Tata McGraw Hill
2. Principles of Metal Working / Sunder Kumar
3. Jig and Fixture Design - Edward G. Hoffman, Thomson
4. Principles of Metal Working processes / G.W. Rowe
5. ASM Metal Forming Hand book.

Subject Code: 10ME115

1.Introduction:

Definition of Mechatronics products, design considerations and trade offs. Overview of Mechtronic products. Intelligent machine Vs Automatic machine economic and social justification.

2.Actuators and Motion Control:

Characteristics of mechanical, Electrical, Hydraulic and pneumatic actuators and their limitations. Control parameters and system objectives, Mechanical Configurations, Popular control system configurations. S-curve, motor/load inertia matching, design with linear slides.

3.Motion Control algorithms:

Significance of feed forward control loops, shortfalls, fundamentals concepts of adaptive and fuzzy – control. Fuzzy logic compensatory control of transformation and deformation non- linearity's.

4.Architecture of intelligent machines:

Introduction to Microprocessor and programmable logic controls and identification of systems. System design classification, motion control aspects in design.

5.Manufacturing data bases:

Data base management system, CAD/CAM data bases, graphic data base, introduction to object oriented concepts, objects oriented model langague interface, procedures and methods in creation, edition and manipulation of data.

6.Sensor interfacing:

Analog and digital sensors for motion measurement, digital transducers, human-Machine and machine- Machine inter facing devices and strategy.

7.Machine vision:

Feature and pattern recognition methods, concepts of perception and cognition in decision- making.

Text Books:

1."Designing intelligent machines ", open university , London Michel B Histand and David G. Alciatore
2. Introduction to Mechatronics and Measurement systems, Tata Mc Graw Hill.
3. C.W.desilva, "Control sensors and actuators , Prentice Hall

Subject Code : 10ME201

COMPUTATIONAL FLUID DYNAMICS

Unit - I Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions. Derivation of finite difference equations.

Unit - II Solution methods: Solution methods of elliptical equations - finite difference formulations, interactive solution methods, direct method with Gaussian elimination.

Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

Unit - III Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations.

Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

Unit - IV Formulations of incompressible viscous flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Unit - V Treatment of compressible flows: potential equation, Eluer equations, Navierstokes system of equations, flowfield-dependent variation methods, boundary conditions, example problems.

Unit - VI Finite volume method: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

Unit - VII Standard variational methods - 1: Linear fluid flow problems, steady state problems.

Unit - VIII Standard variational methods - 2: Transient problems.

Text Books:

1. Computational fluid dynamics, T. J.Chung, Cambridge University press.
2. Text book of fluid dynamics, Frank Chorlton, CBS Publishers & distributors.

Subject Code : 10ME202

CAD THEORY AND PRACTICE

UNIT I :CAD TOOLS:
Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software.

UNIT II:GEOMETRICMODELLING:
Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves

UNIT III:SURFACE MODELING :
Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.

UNIT IV :PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES -
Hermite Bi-cubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface , Sculptured surface, Surface manipulation - Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

UNIT V:GEOMETRICMODELLING-3D:
Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG).

UNIT VI :
CAD/CAM data Exchange: Evaluation of data - exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.

UNIT VII:DESIGN APPLICATIONS:
Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.

UNIT VIII: Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems.

REFERENCE BOOKS :

1. CAD/CAM Theory and Practice / Ibrhim Zeid / Mc Graw Hill international.
2. Mastering CAD/CAM / Ibrhim Zeid / Mc Graw Hill international.
3. CAD/CAM / P.N.Rao / TMH.
4. CAD CAM: Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson edu. (LPE)
5. Concurrent Engineering Fundamentals: Integrated Product Development/ Prasad / Prentice Hall.
6. Successful Implementation of Concurrent Product and Process / Sammy G Sinha / Wiley, John and Sons Inc..

Subject Code : 10ME203

EXPERIMENTAL STRESS ANALYSIS

Unit - I Introduction: Theory of Elasticity, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, Threedimensional stress strain relations.

Unit - II Strain Measurement Methods: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits

Unit - III Recording Instruments: Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

Unit - IV Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

Unit - V Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

Unit - VI Photo elasticity: Photo elasticity - Polariscope - Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials - Isochromatic fringes - Isoclinics

Unit - VII Three dimensional Photo elasticity : Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

Unit - VIII Birefringent Coatings Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringeorder determinations in coatings, stress separation methods.

Reference Books:

1. Theory of Elasticity by Timoshenke and Goodier Jr
2. Experimental stress analysis by Dally and Riley,Mc Graw-Hill
3. A treatise on Mathematical theory of Elasticity by LOVE .A.H
4. Photo Elasticity by Frocht

Subject Code : 10ME204

MECHANICAL VIBRATIONS

Unit I Single degree of Freedom systems I: Undamped and damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation ;Vibration isolation and transmissibility .

Unit II Single degree of Freedom systems II: Response to Non Periodic Excitations: unit Impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

Unit III Vibration measuring instruments : Vibrometers, velocity meters & accelerometers

Unit IV Two degree freedom systems: Principal modes - undamped and damped free and forced vibrations ; undamped vibration absorbers ;

Unit V Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi - rotor systems and geared systems; Discrete-Time systems.

Unit VI Numerical Methods: Rayliegh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

Unit VII Continuous systems: Free vibration of strings - longitudinal oscillations of barstraverse vibrations of beams- Torsional vibrations of shafts.

Unit VIII Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

Reference books:

1. Elements of Vibration Analysis by Meirovitch.
2. Mechanical Vibrations by G.K. Groover.
3. Vibrations by W.T. Thomson
4. Mechanical Vibrations - Schaum series.
5. Vibration problems in Engineering by S.P. Timoshenko.
6. Mechanical Viabrations - V.Ram Murthy.

Subject Code : 10ME205

ADVANCED OPTIMIZATION TECHNIQUES

UNIT - I Linear programming: Two-phase simplex method, Big-M method, duality, interpretation, applications.

UNIT - II Assignment problem: Hungarian's algorithm, Degeneracy, applications, unbalanced problems, traveling salesman problem.

UNIT - III Classical optimization techniques: Single variable optimization with and without constraints, multi - variable optimization without constraints, multi - variable optimization with constraints - method of Lagrange multipliers, Kuhn-Tucker conditions.

UNIT - IV Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - V Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

UNIT - VI Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT - VII Multi-Objective GA: Pareto's analysis, Non-dominated front, multi - objective GA, Non-dominated sorted GA, convergence criterion, applications of multiobjective problems .

UNIT VIII Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

Text Books:

1. Optimal design - Jasbir Arora, Mc Graw Hill (International) Publishers

2. Optimization for Engineering Design - Kalyanmoy Deb, PHI Publishers

3. Engineering Optimization - S.S.Rao, New Age Publishers

4. Genetic algorithms in Search, Optimization, and Machine learning - D.E.Goldberg, Addison-Wesley Publishers

5. Genetic Programming- Koza

6. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

Subject Code : 10ME206

APPLIED SOLAR ENERGY

1. **SOLAR RADIATION:**Pyrhelio and pyranometers-earth-sun angles-equation of time-estimation of average radiation falling on tilted surface.

2. **FLAT PALTE COLLECTORS:**
   Construction-thermal performance-factors influencing efficiency.

3. **FOCUSSING COLLECTORS:**
   Relative merits & demerits-nomenclature-various configurations-thermal performance & losses.

4. **THERMAL STORAGE:**
   Need-location-design parameters-thermal analysis of non-stratified storage-principle of stratification.

5. **ECONOMICS:**
   Discounted cash flow-life cycle coasting of a solar system, production function, cost function & optimization.

6. **THERMAL POWER:**
   The power concept - design aspects - distributed receiver concept- thermochemical reactors.

7. **SOLAR POND & SOLAR STILL:**
   Working principle- construction- operating difficulties and remedies.

8. **AGRICULTURAL & DOMESTIC APPLICATIONS:**
   Stills, timber - drying, crop - drying, cookers.

REFERENCE BOOKS:

1. Solar Energy Thermal Process, Duffie & Beckman.
2. Solar Heating & Cooling, Kreith & Kreider.
3. Solar Power Engineering, Magal.
4. Solar Energy Utilization, G.D. Rai.

Subject Code : 10ME207

DESIGN OF HEAT TRANSFER EQUIPMENT

1. **DESIGN OF HEAT EXCHANGERS:**
   Exchangers-mean temperature differences for parallel and counter flow- effectiveness method(N.T.U)-keys and London charts.

2. **DESIGN OF CONDENSERS:**
   Types overall heat transfer coefficients- temperature distribution and heat flow in a condenser-pressure drop in a condenser -extended fin surfaces-consideration of fouling factor-L.M.T.D. correction factor.

3. **DESIGN OF EVAPORATORS TYPES:**
   Temperature distribution and heat flow in an evaporator-pressure drop- factor to be consider in the design of heat transfer equipment-types of heat consideration of fouling factor -correction factor

4. **DESIGN OF COOLING ROWERS AND SPRAY PONDS:**
   Classification-performance of cooling towers - analysis of counter flow cooling towersenthalpy-temperature diagram of air and water- cooling ponds- types of cooling ponds - cross flow cooling towers- procedure for calculation of outlet conditions.

5. **DESIGN OF COMPRESSORS:**
   Types-equivalent shaft work-volumetric efficiency-factors affecting total volumetric efficiency -compound compression with inter cooling- rotary compressors-surging.

6. **DESIGN OF DUCTS:**
   Continuity equation-Bernoulli's equation-pressure losses-frictional charts- coefficient of resistance for fillings- duct sizing methods.

7. **DESIGN OF FANS:**
   Standard air-fan horsepower-fan efficiency-similarity laws-fan laws-performance coefficients- theoretical expression for total pressure drop by a fan-centrifugal fan- axial flow fan-system resistance.

8. **PIPING SYSTEM:**
   Requirements of a good piping system-pressure drop in pipes-moody chart-refrigerant piping-discharge line-liquid line-suction line-piping arrangement

REFERENCE BOOKS:

1. Heat and mass transfer by Arora & Domkundwar.
2. Refrigeration & Air-Conditioning by P.L.Ballaney
3. .Refrigeration & Air-Conditioning by C.P.Arora.
4. .Refrigeration & Air-Conditioning by Stoecker

Subject Code : 10ME208

REFRIGERATION EQUIPMENT AND CONTROLS

1. Compressors - types - equivalent shaft work - Volumetric efficiency - factors affecting total volumetric efficiency - compound compression with inters cooling - rotary compressors - surging - screw compressors - lubricating oils.

2. Condensers - types -Water cooled Condensers-Air cooled, Evaporative types - Economic water rate - Economic water velocity - over all heat transfer co-efficient - design - temperature distribution and heat flow in a condenser - pressure drop - fouling factor - LMTD correction factor (no problems).

3. Cooling towers and spray ponds - classification - performance of cooling towers - analysis of counter flow cooling towers - enthalpy - temperature diagram of air and water - cooling ponds - types - cross flow cooling towers - procedure for calibration of outlet conditions.

4. Evaporators - types - Flooded and dry Evaporators, natural and forced convection type - shell and tube - shell and coil, plate type - secondary Evaporators - temperature distribution and heat flow in evaporator - pressure drop - fouling correction factor (no problems).

5. Defrosting - necessity - methods - manual, automatic, periodic defrosting, solid and liquid adsorbents, water defrosting, defrosting by reversing the cycle, automatic hot gas defrosting, thermo balance defrosting, electric control defrosting. (no problems)

6. Expansion devices - Capillary tube, thermostatic expansion valve - float valves, externally equalized valves - automatic expansion valves - solenoid control valve - location of piping and pump design consideration.(no problems)

7. Performance of complete Vapour compression system-Performance of condensing unit-compressor -Evaporator-balancing of load in two stage compression.(no problems)

8. Installation of vapour compression refrigeration system - evaluation and dehydration testing for leakages - charging - adding oil.(no problems)

REFERENCES:

1.'Refrigeration and Air Conditioning'- by Stoecker - TMGH- International Edition
2. 'Refrigeration and Air Conditioning' - by Domkundwar - Dhanpat Rai & Co.
3. 'Refrigeration and Air Conditioning' - by - C.P.Arora - TMGH
4. ASHRAE Guide and Data book applications.

Subject Code : 10ME209

I.C. ENGINES AND ALTERNATE FUELS

1. Introduction: Historical Review -Broad classification of fuels - Engine Types - Design and operating Parameters.

2. Cycle Analysis: Thermo-chemistry of Fuel - Air mixtures, properties - Ideal Models of Engine cycles - Real Engine cycles difference and Factors responsible for - Computer Modeling and simulation of combustion process.

3. Gas Exchange Processes: Volumetric Efficiency - Flow through ports - Supercharging and Turbo charging. Exhaust gas recirculation system and their designing.

4. Charge Motion: Mean velocity and Turbulent characteristics - Swirl, Squish - Pre-chamber Engine flows. Fuel supply systems for SI and CI engines to use gaseous fuels like LPG, CNG, and Hydrogen.

5. Engine Combustion: Combustion and Speed - Cyclic Variations - Ignition - Abnormal combustion Fuel factors.

6. Combustion in CI engines: Essential Features - Types of Cylinders. Pr. Data - Fuel Spray Behavior - Ignition Delay - Mixing Formation and control:

7. Pollutant Formation and Control: Nature and extent of problems - Nitrogen Oxides, Carbon monoxide, Unburnt Hydrocarbon and particulate emission - Measurement - Exhaust Gas Treatment. Catalytic converter, 2 way type & 3 way type.

8. Modern Trends in IC Engines: Computer Simulation and Optimized Design -Lean Burning and Adiabatic concepts - Rotary Engines. Modification in IC Engines to suite Bio-Fuels

REFERENCES:

1. I.C. Engines Fundamentals/Heywood/Mc Graw Hill
2. I.C. Engines /Ferguson
3. I.C. Engines / Maleev
4. IC Engines / V Ganesan
5. I.C. Engine in theory and Practice Vol. I and II / Taylor
6. I.C. Engines / Obert / Int.Text Book Co.
7. Combustion Engine Processes / Lichty
8. Scavenging of two stroke Cycle Engines / Switzer

Subject Code : 10ME210

INTELLIGENT MANUFACTURING SYSTEMS

UNIT I:
Computer Integrated Manufacturing Systems - Structure and functional areas of CIM system - CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM.

UNIT II:
Manufacturing Communication Systems - MAP/TOP, OSI Model, Data Redundancy, Topdown and Bottom-up Approach, Volume of Information. Intelligent Manufacturing - System Components, System Architecture and Data Flow, System Operation.

UNIT III:
Components of Knowledge Based Systems - Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT IV:
Machine Learning - Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

UNIT V:
Automated Process Planning - Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning.

UNIT VI:
Knowledge Based System for Equipment Selection (KBSES) - Manufacturing system design, Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KBSES.

UNIT VII:
Group Technology: Models and Algorithms - Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation - Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method.

UNIT VIII:
Knowledge Based Group Technology - Group Technology in Automated Manufacturing System, Structure of Knowledge based system for group technology (KBSGT) - Data Baswe, Knowledge Base, Clustering Algorithm.

Text Books:

1. Intelligent Manufacturing Systems by Andre Kusaic.
2. Artificial Neural Networks by Yagna Narayana
3. Automation, Production Systems and CIM by Groover M.P.
4. Neural Networks by Wassarman.

Subject Code : 10ME211

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

UNIT-I : Logistics and Competitive Strategy: Competitive advantage through logistic - Mission - Integrated supply chains - Models in Logistics Management - Logistics to supply Chain Management - Focus areas in supply Chain Management - performance Measures for SCM.

UNIT-II : Customer Service Dimension: The marketing and logistics interface - Customer service and customer retention - Service driven logistics systems - Basic service capability - Increasing customer expectations - Value added services - Customer satisfaction and success - Time based logistics.

UNIT-III : Logistics System Design: Logistics positioning - Logistics reengineering - reengineering procedure - logistics environmental assessment - time based logistics - alternative logistics strategies - strategic integration - logistics time based control techniques.

UNIT-IV

Measuring Logistics Costs and Performance: The concept of Total Cost analysis - Principles of logistics costing - Logistics and the bottom line - Impact of Logistics on Shareholder value - customer profitability analysis - direct product profitability - cost driver and activity based costing.

UNIT-V : Logistics and Supply chain relationships: Benchmarking the logistics process and SCM operation - Mapping the supply chain processes - Supplier and distributor benchmarking - setting benchmarking priorities - identifying logistics performance indicators - Channel structure - Economics of distribution - channel relationship - logistic service alliances.

UNIT-VI : Sourcing, transporting and pricing products: Sourcing decisions - transportation in the supply chain - basic transportation economics and pricing - transportation documentation - pricing and revenue management in the supply chain - pricing and revenue management in supply chains.

UNIT-VII : Coordination and Technology in Supply chain: Lack of coordination and Bullwhip Effect - obstacles to coordination - managerial levers to achieve coordination - Building strategic partners and trust within a supply chain. Role of IT in the supply chain - E-business.

UNIT-VIII : Managing global logistics and global supply chains: Logistics in a global economy - global operating levels - interlink global economy - Global supply chain business processes - Global strategy, purchasing, logistics - Global alliances - Issues and Challenges.

Reference Books:

1. Donald J. Bowersox and David J. Closs, Logistical Management: The Integrated Supply Chain Process, TMH.
2. Martin Christopher, Logistics Supply Chain Management, Pitman, London.
3. Sunil Chopra and Peter Meindl: Supply Chain Management: Strategy, Planning and Operation, Pearson Education, New Delhi.
4. B.S.Sahay, supply Chain Management for Global competitivesness, Macmillan.
5. Philip B.Schary, Tage Skjott - Larsen: Manageing the Global Supply Chain.
6. Arjun J Van Weele: Purchasing and Supply Chain Management- Analysis, Planning and Practice, Thomson Learning.
7. Ballou, Business Logistics/Supply chain management, Pearson Education.

Subject Code : 10ME212

SIMULATION AND MODELLING

UNIT I:
System - ways to analyze the system - Model - types of models - Simulation - Definition - Types of simulation models - steps involved in simulation - Advantages & Disadvantages.

UNIT II :
Parameter estimation - estimator - properties - estimate - point estimate - confidence interval estimates - independent - dependent - hypothesis - types of hypothesis- steps - types 1& 2 errors - Framing - strang law of large numbers.

UNIT III:
Building of Simulation model - validation - verification - credibility - their timing - principles of valid simulation Modeling - Techniques for verification - statistical procedures for developing credible model.

UNIT IV:
Modeling of stochastic input elements - importance - various procedures - theoretical distribution - continuous - discrete - their suitability in modeling.

UNIT V:
Generation of random variates - factors for selection - methods - inverse transform - composition - convolution - acceptance - rejection - generation of random variables - exponential - uniform - weibull - normal Bernoullie - Binomial - uniform - poisson

UNIT VI :
Simulation languages - comparison of simulation languages with general purpose languages - Simulation languages vs Simulators - software features - statistical capabilities - G P S S - SIMAN- SIMSCRIPT -Simulation of M/M/1 queue - comparison of simulation languages.

UNIT VII :
Output data analysis - Types of Simulation w.r.t output dat analysis - warmup period- Welch algorithm - Approaches for Steady - State Analysis - replication - Batch means methods - comparisons.

UNIT VIII :
Applications of Simulation - flow shop system - job shop system - M/M/1 queues with infinite and finite capacities - Simple fixed period inventory system - Newboy paper problem.

Text books:

1. Simulation Modelling and Analysis, Law, A.M.& Kelton, McGraw Hill, 2nd Edition, New York.
2. Discrete Event System Simulation, Banks J. & Carson J.S., PH, Englewood Cliffs, NJ.
3. Simulation of Manufacturing Systems, by Carrie A., Wiley, NY.
4. A Course in Simulation, Ross, S.M., McMillan, NY.
5. Simulation Modelling and SIMNET, Taha H.A., PH, Englewood Cliffs, NJ

Subject Code : 10ME213

SPECIAL MANUFACTURING PROCESSES

UNIT I:
Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT II:
Non-Traditional Machining: Introduction, need, AJM, Parametric Analysis, Process capabilities, USM -Mechanics of cutting, models, Parametric Analysis, WJM -principle , equipment , process characteristics , performance.

UNIT III:
EDM - principles, equipment, generators , analysis of R-C circuits, MRR , Surface finish, WEDM. ECM - principle, equipment, mechanical properties, MRR, parameter analysis

UNIT IV:
LBM - working , equipment, PAM - working , system ,performance, EBM - working, equipment , process parameters,

UNIT V:
Processing of ceramics : Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying , sintering, Hot compaction, Area of application , finishing of ceramics.

UNIT VI:
Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT VII:
Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in micro electronics, surface mount technology, Integrated circuit economics.

UNIT VIII:
E-Manufacturing, nanotechnology, and micromachining, High Speed Machining.

TEXT BOOKS:

1. Manufacturing Engineering and Technology / Kalpakijian / Adisson Wesley, 1995.
2. Process and Materials of Manufacturing / R. A. Lindburg / 4th edition, PHI 1990.
3. Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van Nostrand Renihold,
4. MEMS & Micro Systems Design and manufacture / Tai - Run Hsu / TMGH
5. Advanced Machining Processes / V.K.Jain / Allied Publications.
6. Introduction to Manufacturing Processes / John A Schey / Mc Graw Hill.

Subject Code : 10ME214

PRODUCTION AND OPERATIONS MANAGEMENT

UNIT-I

Operation Management - Definition - Objectives - Types of production systems - historical development of operations management - Current issues in operation management.

UNIT-II

Product design - Requirements of good product design - product development - approaches - concepts in product development - standardization - simplification - Speed to market - Introduction to concurrent engineering.

UNIT III

Value engineering - objective - types of values -function & cost - product life cycle - steps in value engineering - methodology in value engineers - FAST Diagram -Matrix Method.

UNIT-IV

Location - Facility location and layout - Factors considerations in Plant location - Comparative Study of rural and urban sites - Methods of selection plant layout - objective of good layout - Principles - Types of layout - line balancing.

UNIT-V

Aggregate Planning - definition - Different Strategies - Various models of Aggregate Planning-Transportation and graphical models

UNIT-VI

Advance inventory control systems push systems -Material Requirement - Terminology - types of demands - inputs to MRP- techniques of MRP - Lot sizing methods - benefits and drawbacks of MRP - Manufacturing Resources Planning (MRP -II). Pull systems - Vs Push system - Just in time (JIT) philosophy Kanban System - Calculation of number of Kanbans Requirements for implementation JIT - JIT Production process - benefits of JIT.

UNIT - VII

Scheduling - Policies - Types of scheduling- Forward and Backward Scheduling - Gantt Charts - Flow shop Scheduling - n jobs and 2 machines, n jobs and 3 machines - Job shop Scheduling - 2 jobs and n machines - Line of Balance.

UNIT - VIII

Project Management - Programming Evaluation Review Techniques (PERT) - three times estimation - critical path - probability of completion of project - critical path method - crashing of simple nature.

REFERENCE BOOKS:

1. "Operations Management" by E.S. Buffs.
2. "Operations Management, Theory and Problems" by Joseph G. Monks.
3. "Production Systems Management" by James. L. Riggs.
4. "Production and Operations Management" by Chary.
5. "Operation Management" by Chase
6. "Production & Operation Management" by PannerSelvam
7. "Production & Operation Analysis" by Nahima

Subject Code : 10ME214

ROBOTICS

Unit – I

Fundamentals of Robots: Introduction, definition of robot, classification of robots, History of robotics, robot components, degree of freedom, robot joints, robot coordinates, reference frames, programming modes, robot characteristics, robot work space, robot languages, advantages, disadvantages and applications of robots.

Unit – II

Matrix transformations: Introduction, robots as a mechanisms, matrix representation-representation of a point in a space, representation of a vector in space, representation of a frame at the origin of a reference frame, representation of a frame in a reference frame, representation of a rigid body. Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis, representation of combined transformations, transformations relative to the rotating, inverse of transformation matrices.

Unit – III

Robot kinematics: Forward and inverse kinematics of robots-forward and inverse kinematic equations for position, forward and inverse kinematic equations for orientation, forward and inverse kinematic equations for position and orientation,Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, The inverse kinematic solution and programming of robots, Degeneracy and Dexterity, simple problems with D-H representation.

Unit – IV

Differential motions and Velocities:

Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

Unit – V

Dynamic analysis and forces: Introduction, Lagrangian mechanics, Effective moments of inertia, dynamic equations for multi-degree of freedom robots-kinetic enrgy,potential energy, the Lagrangian,robot's equations of motion, static force analysis of robots.

Unit – VI

Trajectory planning: Introduction, path Vs trajectory, basics of trajectory planning, joint space trajectory planning-third order polynomial trajectory planning, fifth order polynomial trajectory planning, Cartesian-space trajectories.

Unit – VII

Robot Actuators: Introduction,charecterics of Actuating systems-weight, power to weight ratio, operating pressure, stiffness Vs compliance,comparision of actuating systems, hydraulic devices, pneumatic devices,

Electric motors-DC motorcar motors, Brushless DC motors, direct Drive electric motors, servomotors, stepped motors.

Unit – VIII

Robot sensors: Introduction, sensor characteristics,

Position sensors-potentiometers, encoders, LVDT, Resolvers, time of travel displacement sensor, Velocity sensors-Encoders, Tachometers, differentiation of position signal,

Accelerating sensors, force and pressure sensors-piezoelectric, force sensing resistor, strain gauges, Torque sensors, light and infrared sensors, touch and tactile sensors, proximity sensors-magnetic proximity sensors, optical proximity sensors, Ultrasonic proximity sensors, inductive proximity sensors, capacitive proximity sensors, eddy current proximity sensors, sniff sensors.

Text Books:

1. Introduction to Robotics – Analysis, System, Applications by Saeed B. Niku, PHI Publications
2. Industrial Robotics – Mikell P. Groover & Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey – Mc Graw Hill, 1986

References:

1. Robot Modeling and Kinematics – Rachid Manseur, Firewall Media Publishers (An imprint of Laxmi Publications Pvt. Ltd., New Delhi)
2 Robot Analysis and Control - H. Asada and J.J.E. Slotine John Willey & Sons.
3. Fundamentals of Robotics: Analysis and control, Robert J. Schilling, Prentice Hall, 1990.
4. A robot Engineering text book – Mohsen shahinpoor, Harper & Row Publishers,1987

5. Introduction to Robotics: Mechanics and Control, John.J.Craig, Addison- Wesley, 1999
6. Robotics: Control, sensing, vision, and intelligence – K.S. FU, R.C. Gonzalez and C.S.G Lee. Mc Graw Hill, 1987.
7. Modeling and control of Robot manipulators, L. sciavicco and b. Siciliano, Springer (second edition) 2000.

8.ROBOTICS (Fundamental concepts and analysis)ASHITAVA GHOSAL.Oxford university press