JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITYGURAJADA VIZIANAGARAM

SyllabusforPre-Ph.D.Examination

Mechanical Engineering

PAPER–I		Subject Code
S. No	**Subject**	
1	Signal Analysis and Condition Monitoring	PH2403101
2	Fuels, combustion & Environmental Pollution Control	PH2403102
3	Thermal Systems Simulation & Design	PH2403103
4	Combustion & Emission in Engines	PH2403104
5	Computational Fluid Dynamics	PH2403105
6	Advanced Optimization Techniques	PH2403106
7	Theory of Metal Cutting & Tool Design	PH2403107
8	Metal Forming Processes	PH2403108
9	Rapid Prototyping &Tooling	PH2403109
10	Non-Destructive Evaluation	PH2403110
11	Quality Engineering and Manufacturing	PH2403111
12	Mechanics and Manufacturing Methods of Composites	PH2403112

JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITYGURAJADA VIZIANAGARAM

SyllabusforPre-Ph.D.Examination

Mechanical Engineering

PAPER–II		SubjectCode
S.No	**Subject**	
1	CAD Theory & Practice	PH2403201
2	Advanced Mechanical Vibrations	PH2403202
3	Simulation and Modeling	PH2403203
4	Electric & Hybrid Vehicles	PH2403204
5	IC Engines & Alternative Fuels	PH2403205
6	Thermal & Nuclear Power Plants	PH2403206
7	Intelligent Manufacturing Systems	PH2403207
8	Logistics & Supply Chain Management	PH2403208
9	Advances in Manufacturing Technology	PH2403209
10	Production & Operations Management	PH2403210
11	Materials Technology	PH2403211
12	Statistical Quality Control	PH2403212

PAPER – I

(PH2403101)SIGNAL ANALYSIS AND CONDITION MONITORING

UNIT-I

Introduction: Basic concepts. Fourier analysis. Bandwidth. Signal types. Convolution. Signal analysis: Filter response time. Detectors. Recorders. Analog analyzer types.

UNIT-II

Practical analysis of stationary signals: Stepped filter analysis. Swept filter analysis. High speed analysis. Real-time analysis.

UNIT-III

Practical analysis of continuous non-stationary signals: Choice of window type. Choice of window length. Choice of incremental step. Practical details. Scaling of the results.

UNIT-IV

Practical analysis of transients: Analysis as a periodic signal. Analysis by repeated playback (constant bandwidth). Analysis by repeated playback (variable bandwidth).

UNIT-V

Condition monitoring in real systems: Diagnostic tools. Condition monitoring of two stage compressor. Cement mill foundation. I.D. fan. Sugar centrifugal. Cooling tower fan. Air separator. Preheater fan. Field balancing of rotors. ISO standards on vibrations.

Suggested Assignment:

To refer ASME Series of Journal of Tribology for giving a seminar on any current topic of relevance.

TEXT BOOK:

1. Condition Monitoring of Mechanical Systems by Kolacat

REFERENCES:

1. Frequency Analysis by R.B.Randall. Bruel Kjaer, 3rd Ed. 1987
2. Mechanical Vibrations Practice with Basic Theory by V. Ramamurti, Narosa Publishing House.

(PH2403102)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. Coal gas, Blast furnace gas, Alcohols, Biogas and Nuclear fuels.

UNIT II

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 III

Environmental considerations:- Air pollution – Effects on environment, human health, etc., Principal pollutants – Legislative measures – Methods of emission control. Environmental segments, Natural cycles of environment, Atmospheric structure, Green house effect, Ozone hole, Effect of pollution on living systems, Minimum national standards.

UNIT IV

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 V

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.

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

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

Suggested Assignment:

To refer Elsevier Publishers International Journal of Environmental Pollution, Inder Science Publishers International Journal of Environment and Pollution for giving a seminar on any current topic of relevance.

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

(PH2403103)THERMAL SYSTEMS SIMULATION AND DESIGN

AIM: To provide review and use knowledge from thermodynamics, heat transfer and fluid mechanics, modeling and simulation techniques for thermal system component analysis and their synthesis in integral engineering systems and processes

OBJECTIVES:
To learn basic principles underlying piping, pumping, heat exchangers; modeling and optimization in design of thermal systems. To develop representational modes of real processes and systems. To optimization concerning design of thermal systems.

UNIT I
DESIGN CONCEPTS
Design Principles , Workable Systems , Optimal Systems , Matching of System Components , Economic Analysis , Depreciation , Gradient Present Worth factor.

UNIT II
MATHEMATICAL MODELLING
Equation Fitting , Nomography , Empirical Equation , Regression Analysis , Different Modes of Mathematical Models , Selectio n, Computer Programmes for Models.
UNIT III
MODELLING THERMAL EQUIPMENTS
Modelling Heat Exchangers , Evaporators , Condensers , Absorption and Rectification Columns, Compressors, Pumps, Simulation Studies, Information Flow Diagram , Solution Procedures.

UNIT IV
OPTIMIZATION
Objective Function Formulation , Constraint Equations , Mathematical Formulation , Calculus Method , Dynamic Programming , Search Methods , ANN and Genetic Algorithm.
UNIT V
DYNAMIC BEHAVIOUR
Steady state Simulation , Laplace Transformation , Feedback Control Loops , Stability Analysis , Non-Linearities.

Suggested Assignment:
To refer ASME Series of Journal of Heat Transfer, Elsevier Publishers Journal of Applied Thermal Engineering, AIAA Transactions of Journal of Energy for giving a seminar on any current topic of relevance.
TEXT BOOKS:
1. Stoecker W. F., Design of Thermal Systems , McGraw Hill Edition , 1989.
2. Bejan A., George Tsatsaronis , Michael J. Moran , Thermal Design and Optimization , Wiley , 1996.
REFERENCES:
1. Kaput J. N., Mathematical Modelling , Wiley Eastern Ltd , New York , 1989.
2. Yogesh Jaluria , Design and Optimization of Thermal Systems , CRC Press , 2007.
3. Rao S. S., Engineering Optimization Theory and Practice , New Age Publishers ,

(PH2403104)COMBUSTION AND EMISSION IN ENGINES

AIM

To Demonstrate extensive mastery of the fundamental principles which govern the design and operation of internal combustion engines as well as a sound technical framework for understanding real world problems.

OBJECTIVE :

(i) Understand combustion in spark ignition and diesel engines.

(ii) To identify the nature and extent of the problem of pollutant formation and control in internal combustion engines government legislation.

UNIT I

COMBUSTION PRINCIPLES

Combustion – Combustion equations, heat of combustion - Theoretical flame temperature - chemical equilibrium and dissociation - Theories of Combustion - Pre-flame reactions - Reaction rates - Laminar and Turbulent Flame Propagation in Engines.

UNIT II

COMBUSTION IN S.I. ENGINE

Initiation of combustion, stages of combustion, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables, features and design consideration of combustion chambers. Flame structure and speed, Cycle by cycle variations, Lean burn combustion, stratified charge combustion systems. Heat release correlations. After treatment devices for SI engines.

UNIT III

COMBUSTION IN C.I. ENGINE

Stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl measurement, knock and engine variables, features and design considerations of combustion chambers, delay period correlations, heat release correlations, Influence of the injection system on combustion. Direct and indirect injection systems. Afer treatment devices for diesel enignes.

UNIT IV

COMBUSTION IN GAS TURBINES

Flame stability, re-circulation zone and requirements - Combustion chamber configuration, materials.

UNIT V

EMISSIONS

Main pollutants in engines, Kinetics of NO formation, NOx formation in SI and CI engines. Unburned hydrocarbons, sources, formation in SI and CI engines, Soot formation and oxidation, Particulates in diesel engines, Emission control measures for SI and CI engines, Effect of emissions on Environment and human beings.

Suggested Assignment:

To refer SAE Transactions International Journal of Engines, International Journal of Fuels and Lubrications for giving a seminar on any current topic of relevance.

TEXT BOOKS :

1. Ramalingam, K.K., Internal Combustion Engines, Scitech Publications (India) Pvt. Ltd., 2004.
2. Ganesan, V, Internal Combustion Engines, Tata McGraw Hill Book Co., 2003.
3. John B.Heywood, Internal Combustion Engine Fundamentals,McGraw Hill Book, 1998

REFERENCES :

1. Mathur,M.L., and Sharma,R.P., A Course in Internal Combustion Engines, Dhanpat Rai Publications Pvt. New Delhi-2, 1993.
2. Obert,E.F., Internal Combustion Engine and Air Pollution, International Text Book Publishers, 1983.
3. Cohen,H, Rogers,G,E.C, and Saravanamuttoo, H.I.H., Gas Turbine Theory, Longman Group Ltd., 1980.

(PH2403105)COMPUTATIONAL FLUID DYNAMICS

UNIT I
Introduction: Basic tools of CFD, Numerical Vs experimental tools. ; Mathematical Behavior of PDEs: Parabolic, Hyperbolic and Elliptic PDEs.

UNIT II
Methodology of CFDHT: Discrete representation of flow and heat transfer domain: Grid generation, Governing equations and boundary conditions based on FVM/FDM, Solution of resulting set of linear algebraic equations, Graphical representation and analysis of qualitative results, Error analysis in discretization using FVM/FDM.

UNIT III
Solution of 1-D/2-D steady/unsteady: Diffusion problems, Convection problems, Convection-diffusion problems, source term linearization. ; Explicit and Implicit Approach: Explicit and implicit formulation of unsteady problems,

UNIT IV
Stability analysis. ; Solution of Navier-Stokes Equations for Incompressible Flows: Staggered and collocated grid system, SIMPLE and SIMPLER algorithms. ;

UNIT V
Special Topics in CFDHT: Numerical Methodology for Complex Geometry, Multi-block structured grid system, Solution of phase change Problems.

Suggested Assignment:
To refer ASME Series of Journal of Fluids Engineering for giving a seminar on any current topic of relevance.

TEXT BOOK:
1. S.V. Patankar, Numerical Heat Transfer and Fluid Flow, Taylor and Francis, ISBN-10: 0891165223.

REFERENCES:
1. H. K. Versteeg and W. Malalasekra, Introduction to Computational Fluid Dynamics: The Finite Volume Method, Prentice Hall (2nd Edition), ISBN-10: 0131274988.
2. Jr. D. A. Anderson, Computational Fluid Mechanics and Heat Transfer by McGraw-Hill Education
3. M. N. Ozisik, Finite Difference Method, CRC (1st Edition).

(PH2403106)ADVANCED OPTIMIZATION TECHNIQUES

UNIT I

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

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

UNIT II

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.

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 III

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 IV

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

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

UNIT V

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.

Suggested Assignment:

To refer ASME Series of Journal of Engineering Materials and Technology, Journal of Mechanical Design, Elsevier Publishers Finite Elements in Analysis and Design, Simulation modeling Practice and Theory for giving a seminar on any current topic of relevance.

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

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

(PH2403107)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.

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 II

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 III

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.

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 IV

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

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 V

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

Suggested Assignment:

To refer ASME Series of Journal of Manufacturing Science and Engineering, Springer Publishers International Journal of Advanced Manufacturing Technology for giving a seminar on any current topic of relevance.

REFERENCES:

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

(PH2403108)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. 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 II

Forging: Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging. Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, production of seamless pipes.

UNIT III

Drawing: Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing. Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, defect in formed parts.

UNIT IV

Advanced Metal forming processes: HERF, Electromagnetic forming, residual stresses, in process heat treatment, computer applications in metal forming. 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 V

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

Suggested Assignment:

To refer ASME Series of Journal of Manufacturing Science and Engineering, Springer Publishers International Journal of Advanced Manufacturing Technology SAE Transactions International Journal of Materials and Manufacturing for giving a seminar on any current topic of relevance

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.

(PH2403109)RAPID PROTOTYPING AND TOOLING

UNIT I
INTRODUCTION
Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Applications – Digital prototyping - Virtual prototyping.

UNIT II
LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS
Stereolithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, Three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT III
POWDER BASED RAPID PROTOTYPING SYSTEMS
Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations – Case Studies.

UNIT IV
REVERSE ENGINEERING AND CAD MODELING
Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

UNIT V
RAPID TOOLING
Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Applications. Case studies - automotive, aerospace and electronic industries.

Suggested Assignment:
To refer ASME Series of Journal of Manufacturing Science and Engineering, Springer Publishers International Journal of Advanced Manufacturing Technology SAE Transactions International Journal of Materials and Manufacturing for giving a seminar on any current topic of relevance

TEXT BOOKS:
1. Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003.
2. Rapid Tooling: Technologies and Industrial Applications, Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs, CRC press, 2000.

REFERENCES:
1. Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003.
2. Rapid Prototyping and Engineering applications : A tool box for prototype development, Liou W.Liou, Frank W.Liou, CRC Press, 2007.
3. Rapid Prototyping: Theory and practice, Ali K. Kamrani, Emad Abouel Nasr, Springer, 2006

(PH2403110)NON - DESTRUCTIVE EVALUATION

UNIT I

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

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 II

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 III

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

UNIT IV

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 V

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

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

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

Suggested Assignment:

To refer ASTM Series of Journal of Testing and Evaluation for giving a seminar on any current topic of relevance.

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

(PH2403111)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.

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-II

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

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-III

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-IV

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

UNIT-V

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

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

Suggested Assignment:

To refer ASME Series of Journal of Manufacturing Science and Engineering, Springer Publishers International Journal of Advanced Manufacturing Technology SAE Transactions International Journal of Materials and Manufacturing for giving a seminar on any current topic of relevance

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.

(PH2403112)MECHANICS AND MANUFACTURING METHODS OF COMPOSITES

UNIT I

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

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 II

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 III

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 IV

Elastic behavior of unidirectional composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

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 V

Analysis of laminated composite plates

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

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

Suggested Assignment:

To refer ASTM Series of Journal of Composites, Technology and Research and ASTM e-news for giving a seminar on any current topic of relevance.

TEXT BOOKS:

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials by Isaac and M.Daniel, Oxford University Press, 1994.

REFERENCES:

1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.

PAPER II

(PH2403201)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.

GEOMETRIC MODELLING:

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 II

SURFACE MODELING :

Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.

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 III

GEOMETRIC MODELLING-3D:

Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG).

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

UNIT IV

DESIGN APPLICATIONS:

Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.

UNIT V

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

Suggested Assignment:

To refer ASME Series of *Journal of Tribology, Journal of Mechanical Design* for giving a seminar on any current topic of relevance.

REFERENCES :

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..

(PH2403202)ADVANCED MECHANICAL VIBRATIONS

UNIT I

Introduction: Characterization of engineering vibration problems, Review of single degree freedom systems with free, damped and forced vibrations

Two-degree of Freedom Systems: Principal modes of vibration, Spring coupled and mass coupled systems, Forced vibration of an undamped close coupled and far coupled systems, Undamped vibration absorbers, Forced damped vibrations, Vibration isolation.

UNIT II

Multi-degree Freedom systems: Eigen-value problem, Close coupled and far coupled systems, Orthogonality of mode shapes, Modal analysis for free, damped and forced vibration systems, Approximate methods for fundamental frequency- Rayleigh's, Dunkerely, Stodola and Holzer method, Method of matrix iteration, Finite element method for close coupled and far coupled systems.

UNIT III

Free and forced vibration of continuous elastic systems. Longitudinal vibration of rods. The effects of boundaries and discontinuities on longitudinal vibration transmission. Phase closure principle and natural frequencies.

UNIT IV Transient Vibrations: Response to an impulsive, step and pulse input, Shock spectrum

Non-linear Vibrations: Non-linear systems, Undamped and forced vibration with non-linear spring forces, Self-excited vibrations.

UNIT V

Flexural vibration of beams: Derivation of the equation of motion and the procedure to obtain free vibration solutions. Introduction to forced response (harmonic).

Suggested Assignment:

To refer ASME Series of *Journal of Vibration and Acoustics, Journal of Mechanical Design* for giving a seminar on any current topic of relevance.

TEXT BOOKS:

1. Theory and practice of Mechanical Vibrations J.S. Rao and K. Gupta New Age International
2. Mechanical Vibrations (3rd edition), S.S. Rao, Addiston Wesley
3. Mechanical Vibrations G.K. Groover Nem Chand & Brothers
4. Mechanical Vibration Practice V. Ramamurti Narosa Publications
5. Mechanical Vibrations V.P. Singh Dhanpat Rai & sons
6. Textbook of Mechanical Vibrations R.V. Dukkipati & J. Srinivas Prentice Hall of India

(PH2403203)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. 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 II

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

UNIT III

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 IV

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 V

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. 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.

Suggested Assignment:

To refer Elsevier Publishers *Journal of Simulation Modeling Practice and Theory and ASME Journal of Mechanical Design* for giving a seminar on any current topic of relevance.

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

(PH2403204)ELECTRIC AND HYBRID VEHICLES

AIM :

OBJECTIVE: To understand working of different configurations of electric vehicles, and its components, hybrid vehicle configuration and performance analysis.

UNIT I

ELECTRIC VEHICLES

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II

BATTERY

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT III

DC & AC ELECTRICAL MACHINES

Motor and Engine rating, Requirements, DC machines , Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV

ELECTRIC VEHICLE DRIVE TRAIN

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

UNIT V

HYBRID ELECTRIC VEHICLES

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components

Suggested Assignment:

To refer SAE Transactions *International Journal of Engines, International Journal of Fuels and Lubricants, International Journal of Passenger Cars-Electronic & Electrical Systems* for giving a seminar on any current topic of relevance.

REFERENCES :

1. Iqbal Hussain, Electric & Hybrid Vechicles – Design Fundamentals, CRC Press.
2. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles.

(PH2403205)I.C. ENGINES AND ALTERNATE FUELS

UNIT I

ntroduction: Historical Review –Broad classification of fuels - Engine Types – Design and operating Parameters. 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.

UNIT II

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

UNIT III

Engine Combustion: Combustion and Speed – Cyclic Variations – Ignition – Abnormal combustion Fuel factors. Combustion in CI engines: Essential Features – Types of Cylinders. Pr. Data – Fuel Spray Behavior – Ignition Delay – Mixing Formation and control:

UNIT IV

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.

UNIT V

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.

Suggested Assignment:

To refer SAE Transactions *International Journal of Engines, International Journal of Fuels and Lubricants, International Journal of Passenger Cars-Electronic & Electrical Systems* for giving a seminar on any current topic of relevance.

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

(PH2403206)THERMAL AND NUCLEAR POWER PLANTS

UNIT I
Energy scenario. Overview of steam power plant. Analysis of steam cycles. Feedwater heaters. De-aerator and drain cooler. Optimization of cycle parameters, reheat and regeneration. Analysis of multi-fluid coupled cycles. Cogeneration of power and process heat. Combined cycle power generation.

UNIT II
Fuels. Combustion mechanisms. Draft systems. Combustion control. Furnaces for burning coal in fluidized beds and in pulverized form. Coal handling installation.
Different types of boilers and their specific uses. Boiler mountings and accessories. Feedwater treatment.

UNIT III
Boiler maintenance. Circulation theory. Downcomers and risers. Drum and its internals. Economiser. Convective and radiant super heaters. Superheat temperature control. Recuperative and regenerative air preheaters. Dust and ash removal systems. Environmental aspects of power generation

UNIT IV
Basic concepts of reactor physics, radioactivity. Neutron Scattering. Thermal and fast reactors. Nuclear cross-sections. Neutron flux and reaction rates. Moderator criteria. Reactor core design. Conversion and breeding. Types of reactors. Characteristics of boiling water, pressurized water, pressurized heavy water, gas cooled and liquid metal cooled reactors.

UNIT V
Future trends in reactor design and operation. Thermal-hydraulics of reactors. Heavy water management. Containment system for nuclear reactor. Reactor safety radiation shields. Waste management. Indian nuclear power programme.

Suggested Assignment:
To refer Inderscience Publishers *International Journal of Nuclear Science and Technology,* ASME Series of *Journal of Thermal Science and Engineering Applications* for giving a seminar on any current topic of relevance.

TEXT BOOKS:
1. M.M.EI. Wakil., _*Nuclear Power Engineering'*, McGraw Hill Book Company, New York, 1987.
2. S. Glasstone and A. Setonske., _*Nuclear Reactors, Engineering*', 3rd Ed., CBS Publishers and Distributors, 1992.

REFERENCES:
1. Loftness, _*Nuclear Power Plants'*, D. Van Nostrand Company Inc, Princeton, 1964.
2. S. Sarg et al., _*Physics of Nuclear Reactors'*, Tata McGraw Hill Publishing Company Ltd., 1985.
3. T. J. Connoly., _*Fundamentals of Nuclear Energy'*, John Wiley, 1978.

(PH2403207)INTELLIGENT MANUFACTURING SYSTEMS

UNIT I
Computer Integrated Manufacturing Systems – Structure and functional areas of CIM system - CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM. Manufacturing Communication Systems – MAP/TOP, OSI Model, Data Redundancy, Top down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing – System Components, System Architecture and Data Flow, System Operation.

UNIT II
Components of Knowledge Based Systems – Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition. Machine Learning – Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

UNIT III
Automated Process Planning – Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning.

UNIT IV
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 V
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. 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.

Suggested Assignment:
To refer ASME Series of *Journal of Manufacturing Science and Engineering,* Springer Publishers *International Journal of Advanced Manufacturing Technology* SAE Transactions *International Journal of Materials and Manufacturing* for giving a seminar on any current topic of relevance

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.

(PH2403208)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. 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 II

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. 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 III

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 IV

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 V

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 – Ebusiness. 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.

Suggested Assignment:

To refer Elsevier Publishers *International Journal of Computers and Industrial Engineering* Springer Publishers *Journal of Industrial Engineering International* for giving a seminar on any current topic of relevance

REFERENCES:

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.

(PH2403209)ADVANCES IN MANUFACTRURING TECHNOLOGY

AIM:

The aim of this course is to impart knowledge in various fields of advanced manufacturing technology

OBJECTIVE:

At the end of this course the students are expected to understand metal cutting and cutting tool materials, special machining processes, unconventional machining processes, micro machining process and rapid prototyping.

UNIT I

METAL CUTTING AND TOOL MATERIALS

Orthogonal and oblique cutting – types of tool wear, abrasion, diffusion, Oxidation. Fatigue and adhesive wear – Prediction of tool life – Monitoring of wear, Cutting forces and Vibration – tool Materials, Cemented Carbide, Coated Carbide, Cermets. Ceramic, CBN and PCD – Selection of Machining parameters and Tools.

UNIT II

SPECIAL MACHINING PROCESSES & EXPERIMENTAL TECHINIQUES

Deep hole drilling Honing – Lapping – Super finishing – Burnishing – Broaching High speed Machining, Measurement of cutting forces, temperature, Vibration and Tool wear in machining processes.

UNIT III

UNCONVENTIONAL MACHINING

Principles, Processes. Various influencing parameters and Applications of Ultrasonic Machining, Electro Discharge Machining, Electro Chemical Machining, Electron and Laser Beam Machining, Plasma Arc Machining and Water Jet Machining.

UNIT IV

MICRO MACHINING

Introduction to MEMS, principle, process capabilities, types, advantages, limitations and applications of bulk micro machining, surface micro machining and tool based micro machining processes.

UNIT V

RAPID PROTOTYPING

Introduction – Classification – Principle advantages limitations and applications- Stereo lithography – laminated object manufacturing – Selective laser sintering –FDM, SGC, 3D Printing.

Suggested Assignment:

To refer ASME Series of *Journal of Manufacturing Science and Engineering,* Springer Publishers *International Journal of Advanced Manufacturing Technology* SAE Transactions *International Journal of Materials and Manufacturing* for giving a seminar on any current topic of relevance.

TEXT BOOKS:

1. Shaw Milton.C., “Metal Cutting Principles”, Second Edition, Oxford University, Press, 2005.
2. Armarego E.J.A. and Brown R.H., “The Machining of metals”, Prentice Hall, 1982.

REFERENCES:

1. Battacharya, “ theory of metal cutting”, NCB Agency, 1984.

2. HMT Manual, "Non – t5raditional Machining Methods", 1975.
3. Pandley P.S. and shah.N. "Modern Manufacturing Processes", 1980.
4. Sadasivan T.A., and Sarathy.D. "cutting Tools for Productive Machining", Widia (India) Limited 1999.
5. Rich F. and Knight'K., "Artificial Intelligence", McGraw Hill Inc, 1991.
6. Marc J. Madou, Fundamentals of Microfabrication: The Science of Miniaturization, Second Edition, CRC Press (ISBN: 0849308267), 2006.

(PH2403210)PRODUCTION AND OPERATIONS MANAGEMENT

UNIT I

Operation Management – Definition – Objectives – Types of production systems – historical development of operations management – Current issues in operation management. Product design – Requirements of good product design – product development – approaches – concepts in product development – standardization - simplification – Speed to market – Introduction to concurrent engineering.

UNIT II

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

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

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 V

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

Suggested Assignment:

To refer Elsevier Publishers *Journal of Operations Management, International Journal of Production Economics* for giving a seminar on any current topic of relevance

REFERENCES:

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

(PH2403211)MATERIALS 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. 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 II

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. 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 III

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

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 V

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

Suggested Assignment:

To refer ASME Series of *Journal of Engineering Materials and Technology,* SAE Transactions *International Journal of Materials and Manufacturing* for giving a seminar on any current topic of relevance.

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.

(PH2403212)STATISTICAL QUALITY CONTROL

OBJECTIVE:

This course is concerned with the applications of statistical tools in measuring and controlling the quality of products/processes.

UNIT I

QUALITY FUNDAMENTALS

Importance of quality, meaning of quality, quality dimensions, quality planning, quality control, SQC, Quality assurance, quality costs, economics of quality, quality and productivity, quality and reliability, quality loss function.

UNIT II

CONTROL CHARTS FOR VARIABLES

Process variation,– Statistical basis, 3 – sigma control limits, Rational sub-grouping, X ,R and S charts, Interpretation of charts, warning and modified control limits, operating characteristic curve for X – chart, SPC -process capability analysis – Cp, CPK, Cpm, Machine capability, Gauge capability.

UNIT III

CONTROL CHARTS FOR ATTRIBUTES

P, np, C, U and ku charts, demerits control chart, Multi – variable chart, individual measurement charts – moving average and moving range charts, quality control in service sector.

UNIT IV

ACCEPTANCE SAMPLING

Need for Acceptance sampling, economics of sampling, sample selection, single and Double sampling – O.C. curves, Average outgoing quality (AOQ), Average sample Number (ASN), Average total inspection (ATI), Multiple and sequential sampling, sampling plans – military standards, Dodge – Roming, IS 2500.

UNIT V

METROLOGY & INSPECTION

Fundamental methods of measurement, precision & accuracy, measurement devices - Linear and Angular - Coordinate Measuring Machine, Destructive and Non- Destructive Testing methods.

Suggested Assignment:

To refer Springer Publishers *Journal of Industrial Engineering International,* Elsevier Publishers *Computers and Industrial Engineering* for giving a seminar on any current topic of relevance.

TEXT BOOK :

1. Douglus C.Montgomery, Introduction to Statistical Quality Control, John Wiley & Sons, 2004.

REFERENCES :

1. Statistical Quality Control, Eugene L.Grant and Richard S.Leaven Worth, TMH, Seventh Edition, 2000.
2. Quality Control. Dale H.Besterfield, Pearson Education Asia, Seventh Edition,2004.