

UTTRAKHAND TECHNICAL UNIVERSITY
STUDY AND EVALUATION SCHEME
(B.TECH, IV YEAR) VII SEMESTER
B.Tech Mechanical Engineering)
(Effective from the session: 2009:2010)

S. No	Course Code	Subject	PERIOD			EVALUATION SCHEME				SUBJECT TOTAL
			L	T	P	SESSIONAL EXAM			EXAM ESE	
						CT	TA	Total		
1	TME-701	CAD/CAM	3	1	0	30	20	50	100	150
2	TME-702	Experimental stress analysis	3	1	0	30	20	50	100	150
3		ELECTIVE I	3	1	0	30	20	50	100	150
4		ELECTIVE II	3	1	0	30	20	50	100	150
5.		OPEN ELECTIVE	3	1	0	30	20	50	100	150
Practical /Training/Project										
6	PME 751	CAD/CAM	0	0	2		25	25	25	50
7	PME 752	COLLOQUIUM & INDUSTRIAL TRAINING REPORT	0	0	2		50	50		50
8	PME 753	Project	0	0	2		50	50		50
9	PME 754	SEMINAR	0	0	2		50	50		50
10	GP 701	General Proficiency								50
Total										1000
Seminar will be on any technical topic and internal evaluation will be done through a presentation										

TME 701 (CAD/CAM)

UNIT I :

CAD TOOLS: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, Review of C, C++, statements such as if else for while & switch, functions, pointer-notations, structure & class, concept of OOP.

GEOMETRICMODELLING: Output primitives- Bresenham's line drawing and Mid-point circle algorithms. 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 Bicubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface , Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

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

UNIT III :

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

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

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

Introduction to CAD/CAE, Element of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance & necessity.

Finite Element Methods: Introduction and Application of FEM, Stiffness Matrix/ Displacement Matrix, One/Two Dimensional bar & beam element (as spring system) analysis.

UNIT – IV

Features of NC Machines-

Difference between ordinary and NC machine tools. Methods for improving Accuracy and Productivity.

NC Part Programming-

Manual (word address format) programming. Examples Drilling and Milling.

UNIT – V

System Devices- Introduction to DC motors, stepping motors, feed back devices such as encoder, counting devices, digital to analog converter and vice versa.

Interpolators- Principle, Digital Differential Analysers. Linear interpolator, circulator Interpolator and its software interpolator.

Control of NC Systems- Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control

Books/References

1. Computer Graphics by Hearn & Baker (Pearson / Prentice hall)
2. Computer Aided Design by R.K.Srivastava.
3. Computer Graphics –Theory & Practice- Foley, Van Dam, Feiner, (Pearson Education)
4. CAD/CAM Theory and Practice – Ibrahim Zeid (Mc Graw Hill International)
5. Computer Aided Analysis & Design of Machine Elements (Rao & Dukkupati)
6. Mathematical Elements for Computer Graphics – Rogers & Adams (Mc Graw Hill)
7. C AD/CAM – Groover & Zimmers (Prentice Hall of India Pvt Ltd)
8. Computer Oriented Numerical Methods – Rajaraman (Prentice Hall)
9. FEM – SS. Rao.
10. Computer control of Manufacturing systems by Koren
11. NC Machines by Koren
12. CAD/CAM by Groover.
13. NC Machine Tools by S.J. Martin.

TME 702 (Experimental stress analysis)

UNIT I

Elementary Elasticity:

Stress: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Co-ordinate System, Special States of Stress.

Strain: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State of Stress.

UNIT II

Strain Measurements: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid-Method of Strain Analysis.

Brittle Coating Method: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data.

UNIT III

Electrical Resistance Strain Gages: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor.

Strain Gage Circuit: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges.

Analysis of Strain Gage Data: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, Plane Shear-Gage.

UNIT IV

Theory of Photoelasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polariscope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polariscope, Light and Dark

Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors.

UNIT V

Two Dimensional Photoelasticity : Introduction, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for Two-Dimensional Photoelasticity.

Text Books:

1. Experiment Stress Analysis by James W. Dally and William F. Riley, International Student Edition, McGraw-Hill Book Company.
2. Experiment Stress Analysis by Dr. Sadhu Singh, Khanna Publishers.

TME-751 **CAD/CAM Lab**

Say 10 experiments (6 from CAD experiments, 4 from CAM experiment)

A. CAD Experiments-

1. Line drawing or Circle drawing algorithm experiment : writing the program and running it on computer.
2. Transformations algorithm experiment for translation/rotation/scaling : writing program and running it on computer.
3. Design problem experiment : writing the program for design of machine element or other system and running it on computer.
4. Optimisation problem experiment : writing a program for optimising a function and running it on computer.
5. Auto CAD experiment : understanding and use of Auto CAD commands.
6. Writing a small program for FEM for 2 spring system and running it. Or using a FEM package.
7. Use of Graphic software standards packages e.g. GKs/PHICS/GL etc.
8. Use of pro Engineer/Ideas etc.

B. CAM experiments-

1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NC machine
3. Experiment on Robots and its programs
4. Experiment on Transfer line/Material handling.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motors and feedback devices.
7. Experiment on Mechatronics & controls.

LIST OF ELECTIVES

Elective-I

TME-011 Computer Integrated Manufacturing
TME-012 Mechanical Vibrations
TME-013 Management Information System
TME-014 Non conventional energy resources
TME-015 Advanced Engineering Material

Elective-II

TME-021 Optimization Techniques in Engineering
TME-022 Advanced Welding Processes
TME-023 Six Sigma Methods & Applications
TME-024 Non Destructive Testing
TME-025 Hydraulic & Pneumatic Systems

TME 011 Computer Integrated Manufacturing

UNIT 1

Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.

UNIT 2

Computer Aided Design (CAD): CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.

UNIT 3

Computer Aided Manufacturing (CAM): Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP); computer aided production scheduling; computer aided inspection planning; computer aided inventory planning; flexible manufacturing system (FMS); concept of flexible manufacturing;

UNIT 4

Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting.

UNIT 5

Management Information Systems (MIS), Various CIM systems - examples.

References :

1. CAD, CAM, CIM by P.Radhakrishnan and S.Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing by Paul G. Rankey, Prentice Hall.
3. Computer Integrated Manufacturing by Harrington J. Jr., Industrial Press, Inc., New York.
4. Computer Integrated Manufacturing by K.Rathmill and P.Macconal, IFS Publications.
5. Automation, Production Systems and Computer Integrated Manufacturing by M. P. Groover

TME-012

MECHANICAL VIBRATION

UNIT- I

INTRODUCTION: Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, fourier analysis.

Single Degree Freedom System:

Free vibration, Natural frequency, Equivalent Systems, Energy method for determining natural frequency, Response to an initial disturbance, Torsional vibrations, Damped vibrations, Damping models – Structural, Coulomb and Viscous damping, Vibrations of system with viscous damping, Logarithmic decrement, Viscous dampers.

UNIT- II

Single Degree Freedom: Forced Vibration

Forced vibration, Harmonic Excitation with viscous damping, Steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments- Displacement, Velocity, Acceleration and Frequency measuring instrument.

UNIT- III

Two Degree Freedom System:

Introduction, Principal modes, Double pendulum, Torsional system with damping, Coupled System, Undamped dynamic, vibration absorbers, Centrifugal pendulum absorber, Dry friction damper, Untuned viscous damper.

UNIT- IV

Multidegree Freedom System: Exact Analysis

Undamped free and forced vibrations of multidegree system, Influence numbers, Reciprocal Theorem, Torsional vibration of multi rotor system, Vibration of geared system, Principal coordinates, Continuous systems- Longitudinal vibration of bars, Torsional vibrations of Circular shafts, Lateral vibration of beams.

UNIT- V

Multidegree Freedom System: Numerical Analysis

Rayleigh's, Dunkerley's, Holzer's and Stodola's methods, Rayleigh – Ritz method. **5**

Critical Speed of Shafts:

Shafts with one disc with and without damping, Multi-disc shafts, Secondary critical speed.

Reference :

1. Mechanical Vibration – P. Srinivasan – TMH
2. Mechanical Vibration – G. K. Grover – Jain Bros. Roorkee.
3. Mechanical Vibration –W.T. Thomson
4. Mechanical Vibration – Theory & Application – Tse, Morse & Hinkle
5. Introduction Course on Theory and Practice of Mech. Vibration – J.S. Rao & K. Gupta, New Age Publishers.
6. Mechanical Vibration Practice with Basic Theory – V. Rama Murthy – Narosa Publishers.

TME-013**MANAGEMENT INFORMATION SYSTEM****Unit-I**

Organisation & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, Various channels of information & MIS.

Unit-II

Foundation of Information System : Introduction to Information System in Business Fundamentals of Information System, Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS- dataflow diagram, flow chart etc.

Unit-III

Business application of information technology, electronic commerce, Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage.

Unit-IV

Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools.

Unit-V

Advanced concepts in information system: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production & Logistics. Supply Chain Management, CRM, Procurement Management System Object Oriented modeling case studies.

Books

- O.Brian, "Introduction to Information System", Mc-Graw Hill.
O.Brian, "Management Information System", TMH.
Alter, "Information Systems : A Management Perspective", Addison Wesley.
Arora & Bhatia, "Information Systems for Managers", Excel
Bansal, "Information System Analysis & Design", TMH.
Jawadegar, "Management Information System", TMH.
Murdick, "Information System for Modern Management", PHI.
Alexis Leon, "Enterprise Resource Planning", TMH

TME 014
(Non-conventional energy resources)

UNIT-1

Indian and global energy sources, Energy exploited Energy planning, Energy consumption and GDP, Energy demand analysis, National energy plan. Introduction to various sources of non conventional energies.

UNIT-2

Solar energy:

Solar radiations and its geometry:

Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, flux on a plane surface, latitude, expression for angle between, incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length. Solar collectors, Flat plat, Concentric collectors, Cylindrical collectors. Solar energy storage.

UNIT-3

Wind energy:

Properties of wind, Availability of wind energy in India, wind Velocity, wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill,

Geothermal energy:

Principal of working, types of geothermal station with schematic representation,

UNIT-4

Tidal power:

Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems.

Hydrogen Energy:

Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel.

UNIT-5

Electrical energy conservation in building lighting, heating, ventilating and air conditioning, power factor improvement in power systems, Energy audit of Combustion process, Boilers, Turbines, compressors, Pumps, Heat exchangers, Condensers, Use of industrial, wastes.

BOOKS:

Energy Management and condevtion, by Clive Beggs, Butterwoth- Heinemann Elsevier Science.

Optimising Energy Efficiency in the Industry, By Rajan, Tata Mc Graw Hill Publishers.

Guide to energy Management , By C.L Capehart, Fairmont Press.

Renewable Energy Sources and their Environment Impact, by Abbasi & Abbasi, Prentice Hall of India.

Environmental Risks and Hazards by Cutter, Prentice Hall of India.

Energy and Power Risk Management: New Developments in Modeling, Pricing and Hedging, buy

Alexander Eydeland, John Wiley & Sons.

Energy Management Handbook by, Wayne C. Turner.

Thermodynamics, By Kenneth Wark, Tata Mc Graw Hill Publishers.

Exergy Analysis of Thermal, Chemical and Metallurgical Process, By Jan Szargut, David R. Morris,

Bansal Keemann, Meliss," Renewable energy soucesa and conversion technology", Tata Mc Graw Hill.

Rai G.D, "Non-Conventional energy Sources", Khanna Publishers.

Ashok V. Desai, "Nonconventional Energy", New Age Internantional Publishers Ltd.

TME-015

ADVANCE ENGINEERING MATERIALS

UNIT-I

Ferrous Materials, their Properties and Applications:

Plain carbon steels, their properties and application: plain carbon steels, effects of alloying elements in plain carbon steels. Alloy steels, tools steels, stainless steels, low and high temperature resisting steels, high strength steels, selections, specifications, form and availability of steel. Cast irons-white, grey, modular malleable and alloy cast irons. Recognized patterns of distribution of graphite flakes in grey cast iron.

UNIT-II

Heat Treatment of Steels

TTT diagrams, annealing, normalizing, hardening and tempering of steel. Austempering and martempering of steel. Hardenibility, Journing end quench test. Grauisis and its determination. Effect of graion the properties of steel.

Surface hardening of steel :

Carbonising nitriding carbonitriding cyniding, flues and inducation hardenirng microscopic determination of case depth and depth of hardening.

Unit-II

Nonferrous materials, their properties and application, brasses, bronzes, cupro-nickel alloys, aluminum, magnesium and titanium alloys, bearing materials, selection, specific form and availability. Heat treatment of nonferrous materials – soputionising and precipitations hardening

Unit-IV

Composites

Polymer – polymer, metal-metal, ceramic –ceramic, ceramic-polymer, metal-ceramic, metalpolymer composites. Dispersion reinforced, particle reinforced, laminated and fibre reinforced composites.

UNIT-V

ELASIOMERS AND MASULLANEIOUS

Types, properties and identifications of different types of rubbers vulcanisation, fabrication and

forming techniques of rubber. Introduction of plastics and ceramics – types, application and process. Smart materials-introduction and types. Selection of materials and factors effecting deflection, Selection process and systematic evaluation.

TME-021

OPTIMISATION TECHNIQUES IN ENGINEERING

Unit-I

Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.

Unit-II

Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn –Tucker Sufficient Conditions.

Unit-III

Optimization: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg- Marquardt, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Linear Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches – Blue.

Unit-IV

Optimization and Functions of a Complex Variable and Numerical Analysis: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Method and the Runge-Kutta Method for Ordinary Differential Equations, Gaussian Quadrature Trapezoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions, Jacobi's Iteration Method.

Unit-V

Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods.

Books.

1. Winston W L: Operations Research: Applications and Algorithms
2. Rao S.S., Optimization: Theory and Applications.
3. Walsh G R: M methods of Optimization.
4. Williams H.P.: Model Building in Mathematics Programming.
5. Williams H.P.: Model Solving in Mathematics Programming
6. G.L. Nemhauser and L.A. Wolsey: Integer and Combinational Optimization.
7. R.G. Parker and R.L. Rardin: Discrete Optimization.

8. C.H. Papadimitriou and K. Stegillite: Combinational Optimization: Algorithms and Complexity

TME022

ADVANCED WELDING TECHNOLOGY

Unit-I

Introduction : Importance and application of welding, classification of welding process. Selection of welding process.

Review of conventional welding process : Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS, CI, Al, Stainless steel & Maurer/Schacfflar Diagram. Soldering & Brazing.

Unit-II

Advanced welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

Unit-III

Advanced welding Techniques (continued) : Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spray-welding / Metallising, Hard facing.

Unit-IV

Weld Design : Welding machines/equipments and its characteristics. Weld defects and distortion and its remedies, Inspection/testing of welds, Macrostructure & microstructure of welds, HAZ, Weld Design, Welding of pipe-lines and pressure vessels. Life prediction.

Unit-V

Thermal and Metallurgical consideration.: Thermal considerations for welding, temperature distribution, Analytical analysis, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties.

Books

Welding Hand Book

TME 023

SIX SIGMA METHODS & APPLICATION

Unit 1

Quality Perception : Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement.

Descriptive statistics: Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis.

Probability Distribution : Normal, Binomial, Poisson Distribution

Unit 2

Basics of Six Sigma: Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X'S, Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score, Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

Unit 3

Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

Unit 4

Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

Unit 5

Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to softwares for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

References:

1. Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower Publishing Co.
2. Six Sigma for managers, Greg Brue, TMH
3. What is Six Sigma, Pete Pande, TMH
4. The Six Sigma Way, Peter S. Pande, TMH Team Field book
5. The Six Sigma way, Peter S. Pande, TMH

TME-024

Non Destructive testing

Unit-1

INTRODUCTION:

Scope and advantages of N.D.T. some common NDT methods used since ages - visual inspection, Ringing test, and chalk – test (oil-whiting test) their effectiveness in detecting surface cracks, bond strength and surface defects.

Unit-2

Common NDT methods

Dye – penetrant tests – principle, scope, equipment and techniques. Zygo testing. Magnetic Particle Tests- Scope of test, Principle equipment and technique. DC And AC magnetization, use of dry and wet powders magnaglow testing. Interpretations of results.

Unit-3

RADIOGRAPHIC METHODS

X-ray radiography – principle, equipment and methodology. Interpretation of radiographs, Limitations Gamma ray radiography. Principle, equipment, source of radioactive material and technique. Precautions against radiation hazards, Advantage over x-ray radiography methods. 8

Unit-4

ULTRASONIC TESTING METHODS

Introduction Principle of Operation – piezoelectricity. Ultrasonic probes, cathode ray oscilloscope techniques and advantages limitation and typical applications.

Unit-5

Testing of castings, forgings & weldments

Application of NDT methods in inspection of castings, forgings and welded structures with illustrative examples. Case studies. Sample-testing in the lab.

[This course to be offered where NDT laboratory facilities are available]

TME025

Hydraulic & Pneumatic Systems

Fluid Power : Hydraulic and pneumatic power : advantages and applications, Basic concepts and definitions, Desirable properties and types of power transmitting fluid.

Hydraulic & Pneumatic Circuits, Hybrid Circuits and Servo Mechanisms : Pumps, compressors, hydraulic & air motors, linear & rotational actuators, accumulators and pressure intensifiers, Flow direction, non-return and pressure control valves, filters, piping, servo and cartridge valves, hydraulic fuses, pressure and temperature switches – Characteristics and symbols of the components, Hydraulic, pneumatic, hydro-pneumatic, electro-hydraulic and electro-pneumatic circuits and servomechanisms.

Design Analysis and Control of Fluid Powered Systems : Design and construction of simple and compound circuits, linear and rotary motion (speed, position and direction) control, consideration of inertia and compressibility effect; pressure, friction and energy losses, linearized analysis of servo mechanisms, controlling load sensitivity and stability, Fluid logic and electrical controls for fluid power circuits.

Applications of Fluid Powered Circuits : Various circuits for automobiles, machine tools, material handling equipment, robots etc.

Reference Books :

1. Fluid power - By Anthony Esposito Prentice Hall
- 2 Hydraulics & Pneumatics By- Andrew parr Jaico publications
3. Oil Hydraulics : Principles & Maintenance -By Majumdar S.R.
4. Pneumatic and Hydraulic system - By W. Boltan B/H Butterworth, Heinemann
5. Pneumatic systems : Principles and maintenance -By Majumdar S.R. Tata Mc Graw - Hill

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VIII SEMESTER
B.Tech Mechanical Engineering)
(Effective from the session : 2009:2010)
Year IV, Semester VIII

S. No	Course Code	Subject	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL
			L	T	P	SESSIONAL EXAM			EXAM ESE	
						CT	TA	Total		
1	TME 801	Power plant	3	1	0	30	20	50	100	150
2	TME 802	Automobile Engg.	3	1	0	30	20	50	100	150
3		Elective III	3	1	0	30	20	50	100	150
4		Elective IV	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6	PME-852	Automobile Engineering lab	0	0	2		25	25	25	50
7	PME-854	Project	0	0	2		100	100	200	300
9	GP 801	General Proficiency						50		50
Total										1000

TME-801
POWER PLANT ENGINEERING

Unit-I

Introduction

Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, calculations.

Variable Load problem

Industrial production and power generation compared, ideal and realised load curves, terms and factors. Effect of variable load on power plant operation, methods of meeting the variable load problem.

Power plant economics and selection

Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.

Unit-II

Steam power plant

Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boiler mountings and accessories. General layout of steam power plant. Different systems such as fuel handling system, pulverizers and coal burners, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency.

Unit-III

Diesel power plant

General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance.

Gas turbine power plant

Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants.

Unit-IV

Nuclear power plant

Principles of nuclear energy, basic components of nuclear reactions, nuclear power station.

Hydro electric station

Principles of working, applications, site selection, classification and arrangements, hydroelectric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems.

Unit-V

Nuclear fuels in fission and fusion reactors, Types of nuclear reactors, Fissile and fertile materials, Neutron chain reaction in fission reactors, Neutron flux, Concept of criticality for bare homogeneous reactors, Coolants, moderators, Control and structural materials. Heat generations and steady state temperature distribution in fuel elements, Heat removal.

Books:

1. Nuclear Reactor Engineering By S. Glasstone and A . Sesonske.
2. Basic Nuclear Engineering, by K.S. Ram.
3. Introduction to Nuclear Engineering, by J.R Iamarsh.
4. “Power Plant Engineering” F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras.
5. “Power Plant Engineering” Mahesh Verma, Metropolitan Book Company Pvt. Ltd. New Delhi.
6. “Power Plant Technology” El-Vakil, McGraw Hill.
7. Power Plant Engineering by P.K. Nag, Tata McGraw Hill.
8. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, Central Pub.House.

TME-703**AUTOMOBILE ENGINEERING****Unit-I**

INTRODUCTION: Classification of automobile, Parts of an automobile, Description of an automobile, performance of automobile, engine cycle-energy balance, terms connected with I.C. Engines, Detonation, performance number, tractive efforts.

FUEL-SUPPLY SYSTEM:

S.I. ENGINE: Carburetion & carburetors, Induction system, factor influencing carburetion, Mixture requirement, Distribution, Complete carburetor, theory of simple carburetor.

C.I. ENGINE: Functional requirements of an injection system, Fuel pump and fuel injector (Atomizer), Types of nozzles and fuel spray patterns, troubleshooting of a fuel system & carburetor, Turbo Charger (Function and benefits).

Unit II**ENGINE FRICTION, LUBRICATION & COOLING SYSTEM:**

Determination of engine friction, Lubrication, lubrication system, Crankcase ventilation, Necessity of engine cooling, Areas of heat flow in engines, gas temperature variation, heat transfer, temperature distribution & temp. profiles, cooling air and water requirements, cooling systems, troubleshooting of cooling system, gear box (Problems).

Unit III

CHASSIS: Introduction. Classification of chassis, Frame.

SUSPENSION: Introduction, requirements of suspension system, springs, damper.

WHEELS: Introduction, Requirement, types of wheels.

TYRES: Introduction, requirements, types of tyre, tyre construction-cross ply, radial ply, belted bias, tyre materials tyre shape, tread patterns, tyre markings, tyre inflation pressure, causes of wear, factors affecting tyre life, wheel balancing, wheel alignments.

Unit IV

STEERING AND GEARS: Purpose, function, requirements, general arrangements of steering systems, steering gears, steering ratio, reversibility, steering geometry, under steering, over steering, steering arms, Drag link, power steering, adjusting of steering geometry, steering troubleshooting. Requirements. Clutches. Toque converters. Over drive and free wheel,

Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle,

FRONT AXLE: Introduction, construction, types of front axles, stub axles.

BRAKING SYSTEM: Necessity, functions, requirements, classification of brakes, Mechanical brakes, hydraulics brakes, power brakes, brake effectiveness, brake shoe holding down arrangements, brake tester, brake service, troubleshooting chart of hydraulic brakes system, air brakes & Brake shoes & drums.

UNIT V

AUTOMOTIVE ELECTRICAL SYSTEM: Introduction, main parts of vehicles.

STARTING SYSTEM: Introduction, battery, starting motor.

IGNITION SYSTEM: Introduction, purpose, requirements, coil ignition system, firing order, ignition timing, spark plugs, troubleshooting.

CHARGING SYSTEM: Introduction. Dynamo, alternators.

LIGHTING: introduction, main circuits, lighting system.

Maintenance system: Preventive maintenance, break down maintenance, and over hauling system.

References-

1. Automotive Engineering- Hietner
2. Automobile Engineering - Kripal Singh.
3. Automobile Engineering - Narang.
4. Automotive Mechanics- Crouse

TME-851

AUTOMOBILE ENGG. -LAB

Say any 8 study & exp. from the following or such experiments)

1. Study & experiment on braking system.
2. Study & experiment on fuel supply system.
3. Study & experiment on ignition system.
4. Study & experiment on steering system.
5. Study & experiment on transmission system.
6. Study & experiment on suspension system.
7. Study safety aspect of automobile design.
8. Study & experiment on Lighting or lubrication system.
9. Study & experiment on lubrication and cooling system.
10. Comparative study features of common small cars (such as fiat, Ambassador, Maruti, Matiz, Santro, Indica and its variations) available in India.
11. Comparative study & technical features of common scooters & motorcycles available in India. Casestudy/term paper.
12. Comparative Study & Technical features of common heavy vehicles available in India. Case study/term paper.
13. Engine tuning and carburetor servicing experiment.
14. Experiment & study of MPFI system.

15. Experiment on fuel consumption measurement.
16. Review experiment on IC Engines & modern trends.
17. Visit of an Automobile factory.
18. Study & experiment of main gear box and differential gear box.

Elective-III

- TME-031 Total Quality Management (TQM)
- TME-032 Advanced Fluid Mechanics
- TME-033 Mechatronics
- TME-034 Unconventional Manufacturing Processes
- TME-035 Finite Element Method

Elective-IV

- TME-041 Maintenance & safety engg.
- TME-042 Experimental stress analysis
- TME-043 Thermal Turbo Machines
- TME-044 Robotics and automation
- TME-045 Machine Tool Design

TME-031 TOTAL QUALITY MANAGEMENT (TQM)

Unit-I

Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type.

Control on Purchased Product

Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

Unit-II

Quality Management

Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

Human Factor in Quality

Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.

Unit-III

Control Charts

Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

Unit-IV

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Unit-V

ISO-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details

References:

1. Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990. .
2. Greg Bounds. "Beyond Total Quality Management". McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

TME-032

ADVANCED FLUID MECHANICS

UNIT-I

Review of kinematics of fluid motion, method of describing fluid motion, translation, rate of deformation, the material derivatives, acceleration, vorticity in Cartesian & polar coordinates, Reynolds transport theorem, Stress at a point, velocity profile, wall shear stress.

UNIT-II

Non-viscous incompressible flow- Equation of continuity, Euler's equation of motion, Bernoulli's equation, circulation and its theorem, stress function, velocity potential, irrotational flow, two dimensional source, sink, source-sink pair, doublet vortex, superposition of source-sink with rectilinear flow, Rankine body, Superposition of rectilinear flow and doublet, flow around a spinning circular cylinder, Magnus effect, lift & Drag, Skin friction. Lift of aerofoil.

UNIT-III

Boundary layer Concept-Introduction to boundary layer formation, Navier-stokes equation, Boundary layer thickness, momentum thickness, energy thickness, Boundary layer equations, Momentum-Integral equation - Von Korman, Blasius solution of boundary layer on a flat plate without pressure gradient, Flow with very small Reynolds number, Hogen poisseuille flow, Plane Couette flow, Hydrodynamic theory of lubrication.

UNIT-IV

Compressible flow- Propagation of pressure change, sound velocity, elastic waves, Mach number, Mach cone, isentropic flow relations in terms of sonic velocity and mach number, Stagnation properties, Regions of flow, Energy equation, Effect of Mach number on

compressibility. Propagation of infinitesimal waves, Non-steep finite pressure wave and steep finite pressure waves, Expansion waves Isentropic flow with variable area, Mach number variation and its effect on Flow through nozzles and diffusers. Area ratio, impulse function, Use of Gas/Air tables.

UNIT-V

Flow with normal shock waves- Development of shock wave, rarefaction wave, governing equations, Prandtle-Meyer relation. Thermodynamic properties across shock. Wind tunnels.

Flow in constant area duct with friction-Fanno curves, Fanno flow equations, Solution of fanno flow equations. Variation of flow properties. Tables & charts for Fanno flow.

Flow in constant area duct with heat transfer- Rayleigh line, Fundamental equations, Rayleigh flow relation, Variation of flow properties. Tables & Charts for Rayleigh flow.

Books:

1. Fluid Mechanics by White.
2. Fluid Mechanics by Streeter
3. Fluid Mechanics by Som & Biswas
4. Fluid Mechanics by K.L. Kumar
5. Fluid Mechanics by A.K. Jain
6. Fundamentals of Compressible flow by S.M. Yahya
7. Gas Dynamics by Z. Hussain
8. Viscous fluid flow by white
9. Computational Fluid Dynamics by Anderson
10. Gas Dynamics by E. Radhakrishnan

TME-033

MECHATRONICS

Section - I

1 Review of Microprocessors and Micro Controllers: Concepts, Binary numbers to hexadecimal details, information on flipflops, gates, registers, counters, memory, polling and interrupts etc. Architecture, instruction set for 8085, 8051 and assembly level language. Difference between microprocessors and micro controllers. Introduction to programming. Signal and Data Processing: Concepts and principles, analogue signal conditioning, signal level changes, linearization, conversion, filtering. Impedance matching passive circuits. Specifications and circuits in instrumentation. Digital signal conditioning.

2 Ladder Diagram Fundamentals: Basic Components and their symbols, Fundamentals of ladder diagrams, Machine Control Terminology. The Programmable Logic Controller : A Brief History, PLC configurations, System Block Diagrams, Update Solve the ladder – Update, Update, Solve the Ladder

3 Fundamentals of PLC Programming: Physical Components Vs Program, components, Lighting Control Example, Internal Relays, Disagreement Circuit, Majority Circuit, Oscillator, Holding contacts, Always ON and Always OFF Contacts, Ladder Diagram Having more than one rung. Programming On/Off Inputs, to produce on – off outputs : Introduction, PLC input instructions, outputs : Coils, Indicators and others, Operational procedures, Contact and Coil Input output programming Examples, Fail Safe Circuits, Industrial Process Examples.

4 Creating Ladder Diagrams from Process Control Descriptions: Introductions, Ladder Diagrams, Sequence Listings. Large Process Ladder diagram Constructions, Flowcharting as programming Method. Introduction to Robotics: Elementary treatment on anatomy, drives, transmission and end effectors of Robotics

5 Material Handling: Generations Considerations, Applications in material transfer and loading unloading Assembly and Inspections : Assembly and robot assembly automations, Parts presentations methods., Assembly operations, Assembly system configurations inspection automation. Introduction to Nano-technology.

Reference Books:

- 1 "Programmable Logic Controller – Principles and Applications" 5/e, J. W. Webb, R. A. Reis; Prentice Hall of India Ltd. ISBN 81-203-2308-4
- 2 "Industrial Robotics – Technology, Programming and Applications"; M. P. Groover, M. Weiss, R. N. Nagel, N. G. Ordey; McGraw Hill International Editions, Industrial Engineering Series, ISBN 0-0-100442-4
- 3 "Programmable Logic Controller – Programming methods and Applications" Hackworth John R. and Hackworth Frederick D. Jr.; Pearson Education LCE, ISBN 81-297-0340-8.
- 4 Introduction to 8085 – Gaonkar
- 5 Process control and instrumentation – Johnson C.D.
- 6 Introduction to PLC – Gary Dunning – Delmar Pub.
- 7 Various PLC manufacturers catalogue
- 8 Programmable Logic Controller – FESTO Pneumatics, - Bangalore

TME034 UNCONVENTIONAL MANUFACTURING PROCESSES

Unit-I

Introduction: Limitations of conventional manufacturing processes, need of unconventional manufacturing processes and its classification.

Unit-II

Unconventional Machining Process: Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, ultrasonic machining, Abrasive jet machining etc.

Unit-III

Principle and working and application of unconventional machining processes such as laser beam machining, Electron beam machining, Ultrasonic machining etc.

Unit-IV

Unconventional welding processes: Explosive welding, Cladding etc. Under water welding, Metallising, Plasma arc welding/cutting etc.

Unit-V

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc.

Books

1. Modern Machining Processes – P.C. Pandey
2. Unconventional Machining – V.K. Jain

TME-035 FINITE ELEMENT METHOD

UNIT I

Introduction to Finite Difference Method and Finite Element Method, Advantages and disadvantages

UNIT II

Mathematical formulation of FEM, Variation and Weighted residual approaches, Shape functions, Natural co-ordinate system, Element and global stiffness matrix, Boundary conditions, Errors, Convergence and patch test, Higher order elements.

UNIT III

Application to plane stress and plane strain problems, Axi-symmetric and 3D bodies, Plate bending problems with isotropic and anisotropic materials, Structural stability, Other applications e.g., Heat conduction and fluid flow problems.

UNIT IV

Idealisation of stiffness of beam elements in beam-slab problems, Applications of the method to materially non-linear problems, Organisation of the Finite Element programmes, Data preparation and mesh generation through computer graphics, Numerical techniques, 3D problems.

UNIT V

FEM, an essential component of CAD, Use of commercial FEM packages, Finite element solution of existing complete designs, Comparison with conventional analysis.

Books:

1. The Finite Element Method O.C. Zienkiewicz and R.L. Taylor McGraw Hill
2. An Introduction to Finite Element Method J. N. Reddy McGraw Hill
3. Finite Element Procedure in Engineering Analysis K.J. Bathe McGraw Hill
4. Finite Element Analysis C.S. Krishnamoorthy Tata McGraw Hill
5. Concepts and Application of Finite Element Analysis R.D. Cook, D.S. Malcus and M.E. Plesha John Wiley

6. Introduction to Finite Elements in Engineering T.R Chandragupta and A.D.

Belegundu Prentice Hall India

7. Finite Element and Approximation O.C. Zenkiewicy & Morgan -

TME-041

MAINTENANCE & SAFETY ENGINEERING

Unit-I

Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability

Unit-II

Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency.

Unit-III

Replacement planning maintain or replace decision, replacement of items that deteriorate identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning

Unit-IV

SAFETY IN ENGINEERING INDUSTRY:

Introduction - definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage,. disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection. Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks , clamps .general safety consideration in material handling - manual and mechanical handling . Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents.

Unit-V

Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management.

Books:

- 1) Industrial Safety Handbook : William Handley
- 2) Introduction to Safety Engineering : David S Gloss & Miriam GayleWardle
- 3) Industrial Safety : Roland P Blake
- 4) Industrial Hazard & Safety Handbook : Ralph King & John Magid
- 5) Occupational Safety Management & Engg. : Willi Hammer
- 6) Recognition of Health Hazards in Industry : William A Burgess
- 7) Hunters disease of occupation : Dr. Hunter
- 8) Health and Safety in Welding and allied process :N C Balchin,Jaico publishers
- 9.Management of systems – R.N. Nauhria & R. Prakash.
10. Operations Research – Wangner.

TME-042
EXPERIMENTAL STRESS ANALYSIS

UNIT I

Elementary Elasticity:

Stress: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Co-ordinate System, Special States of Stress.

Strain: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State of Stress.

UNIT II

Strain Measurements: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid-Method of Strain Analysis.

Brittle Coating Method: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data.

UNIT III

Electrical Resistance Strain Gages: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor.

Strain Gage Circuit: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges.

Analysis of Strain Gage Data: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, Plane Shear-Gage.

UNIT IV

Theory of Photoelasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polariscopes, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polariscopes, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors.

UNIT V

Two Dimensional Photoelasticity : Introduction, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for Two-Dimensional Photoelasticity.

Text Books:

1. Experiment Stress Analysis by James W. Dally and William F. Riley, International Student Edition, McGraw-Hill Book Company.
2. Experiment Stress Analysis by Dr. Sadhu Singh, Khanna Publishers.

TME-043
THERMAL TURBO MACHINES

UNIT-I

Brief history of turbo machinery, introduction to blowers, pumps, compressors, steam & gas turbines, turbojet, Review of laws of thermodynamics & SFEE in reference to turbo machinery, Energy transfer in turbo machines, Euler's equation, Velocity diagrams for axial & radial turbo machinery and pumps. Definition of various efficiencies, Introduction to blowers, pumps, compressors, steam & gas turbines turbojet.

UNIT-II

Centrifugal compressors- Principle of operation, work done and pressure rise, Diffuser, state losses, slip factors, Performance, characteristics.

Axial flow compressor- basic operation, Elementary theory, Factors affecting stage pressure ratio, Blockage in compressor annulus, Degree of reaction, 3-D flow, Design process, blade design, calculation of stage performance. Supersonic & transonic stages, Performance.

UNIT-III

Axial flow turbines-Elementary theory of axial flow turbine, Vortex theory, Choice of blade profile, pitch and chord, Estimation of stage performance.

UNIT-IV

Steam turbines- Constructional details, working of steam turbine.

Pumps : Pumps, main components, indicator diagram and modification due to piston acceleration, performance and characteristics, axial flow pumps.

Radial flow turbines: Single velocity triangle Enthalpy- Entropy diagram, State losses, performance, Characteristics.

UNIT-V

Gas Turbine Starting & Control Systems: Starting ignition system, combustion system types, safety limits & control.

Turbine Blade coding: Cooling techniques, types

Mechanical Design consideration: Overall design choices, Material selection, Design with traditional materials.

Books-

1. Gas turbine theory : Gohen & Rogers, Addison Wesley Longman Ltd.
2. Design of high efficiency turbomachinery and gas turbines, David Gordon Wilson, Theodosios Korakianitis, Prentice Hall International.
3. Turbomachinery : S.M. Yahya.
4. Turbine, Compressors and Fans, S.M. Yahya, Tata Mc Graw Hill.
5. Gas Turbine- Ganeshan, Tata Mc Graw Hill

TME 044
ROBOTICS AND AUTOMATION

1. Introduction : Brief history, robot terminology, classification, characteristic, physical configuration, structure of industrial robot.
2. Robot and Effectors: Types, mechanical grippers, other types of gripper, tools as end effectors, Robot/end effector interface, design consideration.
3. Robot Motion Analysis & Control : Introduction to manipulator kinematics, robot dynamics, manipulator dynamics, robot control, task planning.
4. Sensors : Transducers and sensors, sensors in robotics, tactile sensors, proximity and range sensors, miscellaneous sensors and sensor-based systems, use of sensors in robotics, touch sensors, force-torque sensors.
5. Machine Vision: Introduction, sensing and digitizing function in machine vision, image processing and analysis, vision system robotic applications.
6. Programming : Basics of robot programming, languages, commands, communications and data processing.
7. Applications : Welding, electro-plating, painting, spraying, assembling, material handling, inspection, Future applications.
8. Introduction to design of robot in specific applications.
9. Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation, Automated flow lines. Automation for machining operations Design and fabrication considerations. Analysis of multi station assembly.
10. Automated Material Handling: components, operation, types, design of automated guided vehicles and applications.
11. Automated storage / retrieval systems - types, basic components and applications.
12. Group Technology: Part families, part classification and coding, machine Cell design, Benefits.
13. Computer Aided Process Planning, benefits and limitations.
14. Automated Inspection And Testing: Automated inspection principles and methods sensors techniques for automated inspection-techniques for automated inspection-contact and non-contact inspection methods-in process gauging, CMM's, construction, types, inspection probes, types, and applications. Machine vision, LASER Micrometer and optical inspection methods.

Reference Books:

1. Industrial Robotics (Technology, Programming and applications) – Mc Graw Hill Editions
2. Robotics – An introduction - Douglas R. Malcolm. Jr -- Delmar Publisher Inc
3. Robot technology fundamentals - Saures G. Keramas - Delmar publishers
4. Fundamentals of robotics – analysis & control - Robert J. Schilling – (PHI) edition
5. Robotics - Control, sensing, vision and Intelligence -K.S. Fy., R.C. gonzaler, C.S.G.Lee -- Mc Graw Hill editions
6. Robotics Technology and flexible Automation – S.R. Deb - Tata Mc. Graw Hill

7. Robotic Engineering and Integrated Approach -- Richard D. Klatter, Negin, Chmielewski -
- Prentice Hall Of India
8. Fundamentals Of Robotics – Analysis And Control - Tsuneo Yoshikawa -- Prentice Hall
Of India.
9. Mikell P. Grower."Automation, Production Systems and CIM", PHI Pvt. Ltd., 1998
- 10.P. Radha Krishnan & S. Subrahmanyam and Raju"CAD/CAM/CIM", New Age
International Publishers, 2003.
- 11.Singh,“System Approach to Computer Integrated Design and Manufacturing “, John
Wiley, 1996.

TME-045

MACHINE TOOL DESIGN

Unit-I

Introduction: Developments in machine tools, types of machine tools surface, profiles and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc. General requirements of machine tool design. Machine tool design process. Tool wear, force Analysis.

UNIT-II

Machine Tools Drives: Classification of machine tool drives, group Vs individual drives, Selection of electric motor, A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system. e.g. pumps, cylinder, directional control valves, pressure valves etc. Fundamentals of Kinematics structure of machine tools.

Unit-III

Regulation of Speed and Feed rates : Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control.

Unit-IV

Design of Machine Tool Structure: Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, column and housing, Model technique in design.

Design of guide ways and power screws: Basic guide way profiles, Designing guide way for stiffness a wear resistance, hydrostatic and antifriction guide ways. Design of sliding friction power Screws. Design of spindle & spindle supports.

Layout of bearings, selection of bearings for machine tools

Unit-V

Dynamics of machine tools: General procedure for assessing the dynamic stability of cutting process, closed loop system, chatter in machine tools.

Control Systems : Functions, requirements & types of machine tool controls, controls for speed & feed change. Automatic and manual Controls. Basics of numerical controls. Machine tool testing.

Books :

1. Machine Tools Design & Numerical Controls –N.K. Mehta, T.M.H. New Delhi.
2. Design of Machine Tools – S.K. Basu Allied Publishers.
3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.

List of Open Electives to be Offered by the Mechanical Engineering

OME-001 Optimization Techniques in Engineering

OME-002 Robotics and automation

OME-003 Advanced Engineering Materials

OME-004 Computer Integrated Manufacturing