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Other university B.E./B.Tech - G MECH Level 4 syllabus

Energy Engineering

Course Code : 402047 Course Name : Energy Engineering

Credits 04

Unit 1: Introduction and Thermal Power Plant 6 Hrs

A) Power Generation : global scenario, present status of power generation in India, in Maharashtra, Role of private and governmental organizations, load shedding, carbon credits, pitfalls in power reforms, concept of cascade efficiency.

B) Thermal Power Plant : General layout of modern thermal power plant with different circuits, site selection criteria, classification of coal, coal blending, coal beneficiation, selection of coal for thermal power plant, slurry type fuels, pulverized fuel handling systems, fuel burning methods, FBC systems, high pressure boilers, ash handling system, Rankine cycle with reheat and regeneration (Numerical Treatment), steam power plants with process heating (Numerical Treatment)

Unit 2: Steam Condenser and Environmental Impacts of Thermal Power Plant 6 Hrs

A) Steam Condenser : Necessity of steam condenser, elements of steam condensing plant, classification, cooling water requirements, condenser efficiency, vacuum efficiency (Numerical Treatment), cooling towers, air leakage and its effects on condenser performance, air pumps (Numerical Treatment for Air Pump capacity)

B) Environmental impact of thermal power plants : Different pollutants from thermal power plants, their effects on human health and vegetation, methods to control pollutants such as particulate matter; oxides of sulphur; oxides of nitrogen, dust handling systems, ESP, scrubbers, water pollution, thermal pollution, noise pollution from TPP and its control

Unit 3: Hydroelectric and Nuclear Power Plant 6 Hrs

A) Hydroelectric Power Plant : site selection, classification of HEPP (based on head, nature of load, water quantity), criteria for turbine selection, dams, spillways, surge tank and forebay, advantages and disadvantages of HEPP, hydrograph, flow duration curve, mass curve, (Numerical Treatment) environmental impacts of HEPP

B) Nuclear Power Plants : elements of NPP, types of nuclear reactor (PWR, BWR, CANDU, GCR, LMCR, OMCR, fast breeder, fusion), material for nuclear fuel, cladding, coolants, control rod and shielding, nuclear waste disposal, environmental impacts of NPP

Unit 4: Diesel and Gas Turbine Power plant 6 Hrs

A) Diesel Power Plants : applications, components of DPP, different systems of DPP, plant layout, performance of DPP (Numerical Treatment) advantages & disadvantages of diesel power plant, environmental impacts of DPP

B) Gas Turbine Power Plant : general layout of GTPP, components of GTPP, open, closed & semi- closed cycle gas turbine plant, Brayton cycle analysis for thermal efficiency, work ratio, maximum & optimum pressure ratio, methods to improve thermal efficiency of GTPP: inter-cooling; reheating & regeneration cycle (numerical treatment), gas and steam turbine combined cycle plant, environmental impacts of GTPP

Unit 5: Non-Conventional Power Plants 6 Hrs

Solar Power Plant based on: flat plate collector, solar ponds, parabolic solar collector, heliostat, solar chimney, SPV cell based plants: working principal, solar photovoltaic systems, applications Geothermal Plant: superheated steam system, flash type, binary cycle plant.

Tidal Power Plant: components, single basin, double basin systems.

OTEC Plant: principal of working, Claude cycle, Anderson Cycle.

MHD Power Generation : Principal of working, Open Cycle MHD generator, closed cycle MHD

generators. Fuel cell : alkaline, acidic, proton-exchange membrane

Wind Power Plant : wind availability, wind mills and subsystems, classification of wind turbines, operating characteristics, wind solar hybrid power plants, challenges in commercialization of non-conventional power plants, environmental impacts of NCPP Faculty of Science and Technology Mechanical Engineering Page 37 of 62

Unit 6: Instrumentation and Economics of Power Plant 6 Hrs

A) Power Plant Instruments : layout of electrical equipment, generator, exciter, generator cooling, short circuits & limiting

methods, switch gear, circuit breaker, power transformers, methods of earthing, protective devices & control system used in power plants, measurement of high voltage, current and power, control room

B) Economics of Power Generation : cost of electric energy, fixed and operating cost [methods to determine depreciation cost] (Numerical Treatment), selection and type of generation, selection of generation equipment , load curves, performance and operation characteristics of power plants, load division, all terms related to fluctuating load plant (Numerical Treatment)

Books

Text :

1. Domkundwar & Arora, Power Plant Engineering, Dhanpat Rai & Sons, New Delhi
2. Domkundwar & Domkundwar- Solar Energy and Non-Conventional Sources of Energy, Dhanpat Rai& Sons, New Delhi.
3. R.K.Rajput, Power Plant Engineering?, Laxmi Publications New Delhi.
4. D.K.Chavan & G.K.Phatak, Power Plant Engineering?, Standard Book House, New Delhi.

References :

1. E.I.Wakil, Power Plant Engineering?, McGraw Hill Publications New Delhi
2. P.K.Nag, Power Plant Engineering?, McGraw Hill Publications New Delhi.
3. R.Yadav , Steam and Gas Turbines? ,Central Publishing House, Allahabad.
4. G.D.Rai, Non-Conventional Energy Sources, Khanna Publishers,Delhi
5. S.P.Sukhatme, Solar Energy? Tata McGraw-Hill Publications, New Delhi
6. G R Nagpal Power Plant Engineering , Khanna Publication

Mechanical System Design

Course Code : 402048 Course Name : Mechanical System Design

Credits TH : 04 TW : 01

Unit 1: Design of Machine Tool Gear Box 8 Hrs

Introduction to machine tool gearboxes, design and its applications, basic considerations in design of drives, determination of variable speed range, graphical representation of speed and structure diagram, ray diagram, selection of optimum ray diagram, gearing diagram, deviation diagram. (Note: Full design problem to be restricted up to 2 Stages only)

Unit 2: Statistical Consideration in Design 8 Hrs

Frequency distribution-Histogram and frequency polygon, normal distribution - units of central tendency and dispersion- standard deviation - population combinations - design for natural tolerances - design for assembly - statistical analysis of tolerances, mechanical reliability and factor of safety.

Unit 3: Design of Belt Conveyor System for Material Handling 8 Hrs

System concept, basic principles, objectives of material handling system, unit load and containerization.

Belt conveyors, Flat belt and troughed belt conveyors, capacity of conveyor, rubber covered and fabric ply belts, belt tensions, conveyor pulleys, belt idlers, tension take-up systems, power requirement of horizontal belt conveyors for frictional resistance of idler and pulleys.

Unit 4: Design of Cylinders and Pressure Vessels 8 Hrs

Design of Cylinders: Thin and thick cylinders, Lame's equation, Clavarino's and Bernie's equations, design of hydraulic and pneumatic cylinders, auto-frettage and compound cylinders, (No Derivation) gasketed joints in cylindrical vessels (No derivation).

Design of Pressure vessel : Modes of failures in pressure vessels, unfired pressure vessels, classification of pressure vessels as per I. 2825 - categories and types of welded joints, weld joint efficiency, stresses induced in pressure vessels, materials for pressure vessel, thickness of cylindrical shells and design of end closures as per code, nozzles and openings in pressure vessels, reinforcement of openings in shell and end closures - area compensation method, types of vessel supports (theoretical treatment only).

Unit 5: Design of I.C. Engine Components 8 Hrs

Introduction to selection of material for I. C. engine components, Design of cylinder and cylinder head, construction of cylinder liners, design of piston and piston-pins, piston rings, design of connecting rod. Design of crank-shaft and crank-pin, (Theoretical treatment only).

Unit 6: Optimum Design 8 Hrs

Objectives of optimum design, adequate and optimum design, Johnson's Method of optimum design, primary design equations, subsidiary design equations and limit equations, optimum design with normal specifications of simple machine elements- tension bar, transmission shaft and helical spring, Pressure vessel Introduction to redundant specifications (Theoretical treatment).

Books

Text :

1. Bhandari V.B. —Design of Machine Elements||, Tata McGraw Hill Pub. Co. Ltd.
2. Juvinal R.C, Fundamentals of Machine Components Design, Wiley, India

References :

1. Design Data- P.S.G. College of Technology, Coimbatore.
2. Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd.
3. I.S. 2825: Code for unfired pressure vessels.
4. Shigley J. E. and Mischke C.R., —Mechanical Engineering Design||, McGraw Hill Pub. Co
5. M. F. Spotts, —Mechanical Design Analysis||, Prentice Hall Inc.
6. Black P.H. and O. Eugene Adams, —Machine Design|| McGraw Hill Book Co. Inc.
7. Johnson R.C., —Mechanical Design Synthesis with Optimization Applications||, Von Nostrand Reynold Pub.
8. S.K. Basu and D. K. Pal, —Design of Machine Tools, Oxford and IBH Pub Co.
9. Rudenko,||Material Handling Equipment||, M.I.R. publishers, Moscow
10. P. Kannaiah ,||Design of Transmission systems||, SCIETCH Publications Pvt Ltd.
11. Pandy, N. C. and Shah, C. S., Elements of Machine Design, Charotar Publishing House.
12. Mulani, I. G., —Belt Conveyors||
13. Singiresu S. Rao, Engineering Optimization: Theory and Practice, John Wiley & Sons.
14. M.V. Joshi, Process Equipment Design, Mc-Millan.

Hydraulics and Pneumatics

Course Code : 402041

Course Name : Hydraulics and Pneumatics

Credits TH : 03 TH : 03

Unit 1: Basics of Fluid Power and Pumps

Fluid power basics, advantages and limitations, fluid power distribution, standard symbols, energy loss in hydraulic systems. Pumps - types, classification, principle of working and constructional details of vane pumps, gear pumps, radial and axial plunger pumps, screw pumps, power and efficiency calculations, and characteristics curves.

Unit 2: Actuators and Power Unit

Linear and rotary actuators- types, construction and characteristics. Cylinder mountings, cushioning of cylinders. Power units and accessories - types of power units, reservoir assembly, constructional details. Accumulators, Intensifiers, Pressure and Temperature switches /sensors, level sensors.

Unit 3: Fluid Power Control

Direction control valves - center positions, methods of actuation, two stage valves, Flow control valves - pressure and temperature compensated. Pressure control valves - pressure reducing valve, sequence valve, unloading valve, brake valve, back pressure valve, counter balance valve, check valves, prefill valve, servo valves, cartridge valves, proportional valves.

Unit 4: Hydraulic Circuits and Contamination Control

Hydraulic circuits: Simple reciprocating, regenerative, speed control (meter in, meter out and bleed off), sequencing, synchronization, traverse and feed, automatic reciprocating, fail safe circuit, counter balance circuit, actuator locking, unloading circuit, motor breaking circuit etc.

Contamination control: Contamination, sources of contamination, suction strainer, filters, filtration, filter ratings.

Unit 5: Pneumatics - Components, Control Valves and Circuits

Compressors - Types, principle of working and constructional details. Comparison of pneumatic with hydraulic power transmissions. Types of filters, pressure regulators, lubricators, mufflers, dryers, direction control valves, pneumatic actuators, shuttle valve, two pressure valve, quick exhaust valve and time delay valves, electro-pneumatics. Speed regulating methods, pneumatic circuits, reciprocating,

cascading time delay etc. Application of pneumatics in low cost automation and in industrial automation.

Unit 6: System Analysis and Design

Calculation of piston velocity, thrust under static and dynamic applications, considering friction, inertia loads, design considerations for cylinders, Design of hydraulic/pneumatic circuits for practical application, selection of different components such as reservoir, control elements, actuators, accumulator, intensifier, filters, pumps. (Students are advised to refer manufacturers' catalogues for design and use simulation tool like Automation Studio for analysis).

Books

Text :

1. Esposito A, Fluid Power with application, Prentice Hall
2. Majumdar S.R, Oil Hydraulic system- Principle and maintenance ,Tata McGraw Hill
3. Majumdar S.R, Pneumatics Systems Principles and Maintenance ,Tata McGraw Hill
4. Stewart H. L, Hydraulics and Pneumatics , Taraporewala Publication

References :

1. Pipenger J.J, Industrial Hydraulics, McGraw Hill
2. Pinches, Industrial Fluid Power, Prentice Hall
3. Yeaple, Fluid Power Design Handbook
4. Andrew A. Parr, Hydraulics and Pneumatics, Elsevier Science and Technology Books
5. ISO - 1219, Fluid Systems and components, Graphic Symbols
6. Standard Manufacturer's Catalogues

CAD CAM and Automation

Course Code : 402042

Course Name : CAD CAM and Automation

Credits TH : 03 TW : 01

Unit 1: Computer Graphics

Transformations (2D & 3D) : Introduction, Formulation, Translation, Shear, Rotation, Scaling and reflection, Homogeneous representation, Concatenated transformation, Mapping of geometric models, Inverse transformations, Introduction to 3D transformation

(Theory + Numerical treatment only for 2D - Max 3 vertices)

Projections : Orthographic, Isometric, Perspective projections (Only theory)

Unit 2: Geometric Modeling

Curves - Introduction, Analytical curves (Line, circle, ellipse, parabola, hyperbola), Synthetic curves

(Hermite Cubic Spline, Bezier, B-Spline Curve) [Numerical on Line, Circle, Ellipse, Hermite Cubic Spline, Bezier]

Surfaces - Introduction, Surface representation, Analytic surfaces, Synthetic Surfaces, Hermite bicubic, Bezier, B-Spline, Coons patch surface, Applications in freeform surfaces [only Theory]

Solids - Introduction, Geometry and Topology, Solid Representation, Boundary Representation, Euler's equation, Constructive Solid Geometry (CSG), Boolean operation for CSG [only Theory]

Unit 3: Finite Element Analysis (FEA)

Introduction : Brief History of FEM, Finite Element Terminology (nodes, elements, domain, continuum, Degrees of freedom, loads and constraints), General FEM procedure, Applications of FEM in various fields, meshing, p and h formulation, Advantages and disadvantages of FEM [Only theory]

One Dimensional Problem: Finite element modeling, coordinate and linear shape function, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations, Temperature Effects. [Theory + Numerical - composite shaft, spring elements in series and parallel]

Trusses : Introduction, 2D Trusses, Assembly of Global Stiffness Matrix [Numerical limited to 4X4 matrix]

Unit 4: Computer Aided Manufacturing (CAM)

Introduction to Computer Aided Manufacturing (CAM), Coordinate system, Working principal of CNC Lathe, Turning Centers, Milling Machine, Steps in developing CNC part program, Tool and geometric compensations, subroutine and Do loop using canned cycle. [Only theory - 2 hrs]

CNC Lathe part programming (FANUC) : Linear and circular interpolation, Canned cycles for facing, threading, grooving, etc. [Theory + Program]

CNC Milling part programming (FANUC): Linear and circular interpolation, Pocketing, contouring and drilling cycles. [Theory + Program]

Unit 5: Advanced Manufacturing Method

Product Life Cycle: Introduction, Need, Components/Elements of PLM, Collaborative Engineering. [Only theory]

Rapid Prototyping : Introduction, classification of RP Processes (SLA, LOM, SLS, FDM, 3D printing), Working principle, features, models & specification of process, application, advantages and disadvantages, Rapid Tooling and STL format, Concept of 4D Rapid Prototyping. [Only theory]

Unit 6: Automation

Automation : Introduction, Automation strategies, Types of Automation - Hard and Soft Automation, Flexible Manufacturing System - Types, Advantages, Limitations, AGVs and AS/RS [Only theory]

Group Technology: Introduction, Coding Methods, Concepts of Computer Integrated Manufacturing (CIM) and Computer Aided Process Planning (CAPP), Variant & Generative methods of CAPP, advantages of CAPP. [Only theory]

Robotics: RIA definition of Robot, Laws of robotics, Classification of robots, robot anatomy, Point to point and continuous path robotic systems, Joints, End Effectors, Grippers - Mechanical, Magnetic and Pneumatic, Applications. [Only theory]

Books

Text :

1. Ibrahim Zeid and R. Sivasubramanian - CAD/CAM - Theory and Practice Tata McGraw Hill Publishing Co. 2009
2. Chandrupatla T. R. and Belegunda A. D. -Introduction to Finite Elements in Engineering - Prentice Hall India.
3. Nitin S. Gokhale, Practical Finite Element Analysis, Finite To Infinite; First Edition edition, ISBN-10: 8190619500 ISBN-13: 978-8190619509
4. S. K. Sinha, CNC Programming using Fanuc Custom Macro B, McGraw-Hill Professional
5. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.

References :

1. Ibrahim Zeid, Mastering CAD/CAM - Tata McGraw Hill Publishing Co. 2000
2. Segerling L. J. - Applied Finite Elements Analysis, John Wiley and Sons

3. Seshu P. Text book of Finite Element Analysis, PHI Learning Private Ltd. New Delhi, 2010
4. Rao P. N., Introduction to CAD/CAM Tata McGraw Hill Publishing Co.
5. B. S. Pabla, M. Adithan, CNC Machines, New Age International, 1994
6. Groover M.P.-Automation, production systems and computer integrated manufacturing' - Prentice Hall of India
7. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer
8. Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight, Product Design for Manufacture and Assembly, Third Edition ,CRC Press
9. Antti Saaksvuori, Anselmi Immonen, Product Life Cycle Management -Springer, 1st Edition, 2003

Dynamics of Machinery

Course Code : 402043

Course Name : Dynamics of Machinery

Credits TH : 04 TW : 01

UNIT 1: Single Degree of Freedom Systems - Free Vibration

Fundamentals of Vibration : Elements of a vibratory system, vector representation of S.H.M., degrees of freedom, Introduction to Physical and Mathematical modeling of vibratory systems : Bicycle, Motor bike and Quarter Car. types of vibration, equivalent stiffness and damping, formulation of differential equation of motion (Newton, D'Alembert and energy method)

Undamped free vibrations: Natural frequency for longitudinal, transverse and torsional vibratory systems.

Damped free vibrations: Different types of damping, Viscous damping - over damped, critically damped and under damped systems, initial conditions, logarithmic decrement, Dry friction or coulomb damping - frequency and rate of decay of oscillations.

UNIT 2: Single Degree of Freedom Systems - Forced Vibrations

Forced vibrations of longitudinal and torsional systems, Frequency Response to harmonic excitation, excitation due to rotating and reciprocating unbalance, base excitation, magnification factor, Force

and Motion transmissibility, Quality Factor. Half power bandwidth method, Critical speed of shaft having single rotor of undamped systems.

UNIT 3: Two Degree of Freedom Systems - Undamped Vibrations

Free vibration of spring coupled systems - longitudinal and torsional, torsionally equivalent shafts, natural frequency and mode shapes, Eigen value and Eigen vector by Matrix method, Combined rectilinear and angular motion, Vibrations of Geared systems.

UNIT 4: Balancing

Static and dynamic balancing, balancing of rotating masses in single and several planes, primary and secondary balancing of reciprocating masses, balancing in single cylinder engines, balancing in multi-cylinder in-line engines, direct and reverse cranks method -radial and V engines.

UNIT 5: Measurement and Control of Vibration

A) Measurement: Vibration Measuring Instruments, Accelerometers, Impact hammer, Vibration shakers, Vibration Analyzer, Vibration based condition monitoring, Analysis of Vibration Spectrum, Standards related to measurement of vibration, Human response to vibrations.

B) Control : Vibration control methods, passive, semi active (Introduction to Electro-Rheological & Magneto-Rheological dampers) and active vibration control, control of excitation at the source, control of natural frequency, Vibration isolators, Tuned Dynamic Vibration Absorbers, Introduction to Torsional Damper

UNIT 6: Introduction to Noise

Fundamentals of noise Sound concepts, Decibel Level, white noise, weighted sound pressure level, Logarithmic addition, subtraction and averaging, sound intensity, noise measurement, sound fields, octave band, sound reflection, absorption and transmission, acoustic material & its characteristics, Noise control at the Source, along the path and at the receiver, pass-by-noise, Reverberation chamber, Anechoic Chamber, Human Exposure to Noise and Noise standards.

Books

Text :

1. S. S. Rao, Mechanical Vibrations, Pearson Education Inc. New Delhi.
2. G. K. Grover, Mechanical Vibrations, New Chand and

Bros., Roorkee

3. William J Palm III, Mechanical Vibration, Wiley India Pvt. Ltd, New Delhi

4. Uicker J. John, Jr, Pennock Gordon R, Shigley Joseph E., Theory of Machines and Mechanisms, International Version, OXFORD University Press, New Delhi.

5. M L Munjal, Noise and Vibration Control, Cambridge University Press India

References :

1. Weaver, Vibration Problems in Engineering, 5th Edition Wiley India Pvt. Ltd, New Delhi.

2. Bell, L. H. and Bell, D. H., Industrial Noise Control - Fundamentals and Applications, Marcel Dekker Inc.

3. Alok Sinha, Vibration of Mechanical System, Cambridge university Press , India

4. Debabrata Nag, Mechanical Vibrations, Wiley India Pvt. Ltd, New Delhi.

5. Kelly S. G., Mechanical Vibrations, Schaums outlines, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

6. Meirovitch, L., Elements of Mechanical Vibrations, McGraw Hill.

7. Ver, Noise and Vibration Control Engineering, Wiley India Pvt. Ltd, New Delhi.

8. Bies, D. and Hansen, C., Engineering Noise Control - Theory and Practice, Taylor and Francis.

9. Shrikant Bhave, Mechanical Vibrations Theory and Practice, Pearson, New Delhi

Machine Learning

Machine Learning

UNIT-I

INTRODUCTION - Well defined learning problems, Designing a Learning

System, Issues in Machine Learning; **THE CONCEPT LEARNING TASK** -

General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

UNIT-II

DECISION TREE LEARNING - Decision tree learning algorithm-

Inductive

bias- Issues in Decision tree learning; ARTIFICIAL NEURAL NETWORKS -

Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks,

Derivation of backpropagation rule Backpropagation

Algorithm Convergence,

Generalization;

UNIT-III

Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling

Theory, Comparing Learning Algorithms; Bayesian Learning: Bayes theorem,

Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian

belief networks, EM algorithm;

UNIT-IV

Computational Learning Theory: Sample Complexity for Finite Hypothesis

spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound

Model of Learning; INSTANCE-BASED LEARNING - k-Nearest Neighbour

Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning

UNIT-V

Genetic Algorithms: an illustrative example, Hypothesis space search, Genetic

Programming, Models of Evolution and Learning; Learning first order rules-

sequential covering algorithms-General to specific beam search-FOIL;

REINFORCEMENT LEARNING - The Learning Task, Q Learning.

Non-Destructive Testing

Non-Destructive Testing

Unit-I:

Introduction:

Scope and advantages of NDT, Comparison of NDT with Destructive Testing, some common NDT methods used since ages, Terminology, Flaws and Defects, Visual inspection, Equipment used for visual inspection. Ringing test, chalk test (oil whitening test). Uses of visual inspection tests in detecting surface defects and their interpretation, advantages & limitations of visual inspection.

Unit-II:

Tests:

Die penetrate test (liquid penetrate inspection), Principle, scope. Equipment & techniques, Test stations, Advantages, types of penetrants and developers, Zyglo test, Illustrative examples and interpretation of defects.

Magnetic particle Inspection - scope and working principle, Ferro Magnetic and Nonferromagnetic materials, equipment & testing. Advantages, limitations Interpretation of results, DC & AC magnetization, Skin Effect, use of dye & wet powders for magna glow testing, different methods to generate magnetic fields, Applications.

Unit-III:

Radiographic methods:

Introduction to electromagnetic waves and radioactivity, various decays, Attenuation of electromagnetic radiations, Photo electric effect, Rayleigh's scattering (coherent scattering), Compton's scattering (Incoherent scattering), Pair production, Beam geometry and Scattering factor.

X-ray radiography: principle, equipment & methodology, applications, types of radiations and limitations. γ -ray radiography - principle, equipment., source of radioactive materials & technique, advantages of γ -ray radiography over X-ray radiography Precautions against radiation hazards. Case Study - casting and forging.

Unit-IV:

Ultrasonic testing methods:

Introduction, Principle of operation, Piezoelectricity. Ultrasonic probes, CRO techniques, advantages, Limitation & typical applications. Applications in inspection of castings, forgings, Extruded steel parts, bars, pipes, rails and dimensions measurements. Case Study - Ultrasonography of human body.

Unit-V:

Special NDT Techniques:

Eddy Current Inspection:

Principle, Methods, Equipment for ECT, Techniques,

Sensitivity, advanced ECT methods. Application,

scope and limitations, types of Probes and Case Studies. Introduction

to Holography, Thermography and

Acoustic emission Testing.

Theory of Elasticity

Theory of Elasticity

UNIT I:

Basic Equations of Elasticity:

Definition of Stress and Strain: Stress - Strain Relationships -

Equations of Equilibrium,

Compatibility Equations, Boundary Conditions, Saint

Venant's principle - Principal Stresses, Stress

Ellipsoid - Stress Invariants.

UNIT II:

Plane Stress and Plane Strain Problems:

Airy's Stress Function, Bi-Harmonic Equations, Polynomial Solutions,

Simple Two-Dimensional

Problems in Cartesian Coordinates Like Bending of Cantilever and

Simply Supported Beams.

UNIT III:

Polar Coordinates:

Equations of Equilibrium, Strain - Displacement Relations, Stress -

Strain Relations, Airy's

Stress Function, Axis - Symmetric Problems, Introduction to Dunder's

Table, Curved Beam Analysis,

Lame's, Kirsch, Michell's And Boussinesque Problems - Rotating

Discs.

UNIT IV:

Torsion:

Navier's Theory, St. Venant's Theory, Prandtl's Theory on Torsion,

Semi- Inverse Method and
Applications to Shafts of Circular, Elliptical, Equilateral Triangular
and Rectangular Sections.
Membrane Analogy.

UNIT V:

Introduction to Theory of Plates and Shells:

Classical Plate Theory - Assumptions - Governing Equations -
Boundary conditions - Navier's Method
of Solution for Simply Supported Rectangular Plates Levy's Method
of Solution for Rectangular Plates
Under Different Boundary Conditions.

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