

MECHANICAL ENGINEERING (CODE NO. 03)

1. Engineering Mechanics and Mechanics of Solids

Resultant of a force system; Free body diagram and equilibrium; Analysis of axially loaded components; Stress and strain in two dimension; Mohr's circle; Stress-strain-temperature relations; Shear force and bending moment diagrams; Stresses in beams; Torsion of circular shaft; Basic equations of elasticity; Deflection of beams; Buckling of column using Euler's theory; Theories of Failure; Thin pressure vessels.

2. Theory of Machines

Introduction to different types of mechanisms; Analysis of displacement, velocity and acceleration (Maximum four bar links); Inversion of mechanisms; Power transmission by belt drive; Analysis of simple band brakes; Gears: nomenclature, law of gearing, tooth profiles, interference; Epicyclic gear trains; Cam and followers; Balancing of rotating and reciprocating masses; Free and forced vibration of single degree of freedom system with damping; Whirling of shafts; Gyroscopic stability of shafts, ships and aero-plane.

3. Design of Machine Elements

Fundamentals of machine design: design for static loading, design for dynamic loading, and low and high cycle fatigue; Design of bolted, riveted and welded joints; Design of shafts; Design of Helical Springs; Design of rigid and flexible couplings; Design of clutch for uniform pressure and uniform wear.

4. Production Engineering

Chip formation mechanism, chip types, chip control; Tool geometry of single point cutting tool, Merchant's circle force analysis; Cutting tool wear and tool life, wear mechanisms, wear criterion, Taylor's tool life equation, variables affecting tool life; Machinability and its measures, economics of machining; Advanced machining processes such as Abrasive Jet Machining (AJM), Ultrasonic Machining (USM), Electro Chemical Machining (ECM), Electro-Discharge Machining (EDM), Electron Beam Machining (EBM), and Laser Beam Machining (LBM); Limits, fits, and dimensional and geometrical tolerances; Computer vision system based measurement, coordinate measuring machines; Surface roughness terminology, different methods of surface roughness measurement.

5. Production Management

Production Planning and Control: Functions, forecasting, routing, operations planning; Gantt chart, work order, dispatching and follow-up; CPM and PERT techniques; Inventory Control: purchasing and storing, economic lot size, ABC analysis; Different types of models, formulation of linear programming problems (LPPs), Simplex algorithm, assignment models: transportation problems; Simple queuing problems; Control charts for variables and attributes.

6. Thermodynamics

Basic Concepts; First Law of Thermodynamics for Open and Closed system; Thermodynamic Properties; Second Law of Thermodynamics; Entropy and Entropy Generation; Availability and Exergy; Gas Power Cycle; Vapor Power Cycle.

7. Fluid Mechanics and Machines

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Basic Concepts; Continuity, Momentum and Energy Equations; Flow through Pipes; Velocity Distribution in Laminar and Turbulent Flow; Non Dimensional Numbers; Boundary Layer on a Flat Plate; Adiabatic and Isothermal Flow of Compressible Fluids; Hydraulic Turbines; Impulse and Reaction Turbine; Velocity Diagram of Hydraulic Turbines; Specific Speed.

8. Heat Transfer, Refrigeration and Air Conditioning

Basic Laws of Heat Transfer; Overall Heat Transfer Coefficient, Heat Conduction Through Walls and Pipes; Critical Conduction; Heat Transfer Through Fins of Different Types; Dimensionless Numbers; Lumped Body Heat Transfer; Free and Forced Convection; Radiation Heat Transfer; Concept of Black and Gray Body; View Factor; Heat Exchanger Classification, Effectiveness of Parallel Counter and Cross Flow Heat Exchanger, LMTD and NTU Approach; Fouling Factor.

9. Energy Conversion Systems

Theories of Combustion in Compression Ignition and Spark Ignition Engines; Octane Number and Cetane Number; Abnormal Combustion and Shooting; Carburetion and Fuel Injection; Emission from Engine and Their Control; Modern Trends in IC Engines; Classification of Steam Turbines; and Gas Turbines; Pressure and Velocity Compounding; Nuclear Power Plant; Renewable Energy Sources.

10. Computer Aided Engineering

Introduction to CAD, 2D and 3D Drawing Concepts; Computer Aided Manufacturing NC and CNC Machines, Methods of Part Programming, Elements of Robotics and Automated Material, Handling Systems; FMS and Expert Systems.

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