Mechanical Engineering

Syllabus IURAT

Mechanics of Materials - Elastic constants, Stress and strain, Poisson's ratio, thin cylinders, Mohr’s circle for plane stress and plane strain, shear force and bending moment diagrams, deflection of beams, bending and shear stresses, torsion of circular shafts, energy methods, Euler’s theory of columns, thermal stresses, testing of materials with the universal testing machine, strain gauges and rosettes, testing of hardness and impact strength.

Engineering Mechanics - Trusses and frames; Free body diagrams and equilibrium, virtual work; impulse and momentum (linear and angular), kinematics and dynamics of particles & of rigid bodies in plane motion and energy formulations, collisions.

Theory of Machines - Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Machine Design - Design for static and dynamic loading, Failure theories, fatigue strength and the S-N diagram, gears, shafts, rolling and sliding contact bearings, springs, brakes, and clutches, principles of the design of machine elements like riveted, bolted, and welded joints.

Vibrations - Effect of damping, Free and forced vibration of single degree of freedom systems, resonance, vibration isolation, critical speeds of shafts.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.

Non-conventional Machining: EDM, ECM, AJM, EBM

Thermodynamics: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. Irreversibility and availability; behavior of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion. Solar energy and their wide applications. Energy Management and gasification, Solid waste energy etc.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

I.C.Engines: Air Standard cycles, Normal and Abnormal Combustion in S.I. engines and C.I.engines., Engine performance, Alternative Fuels for I.C. Engines.

Refrigeration and Air Conditioning: Refrigeration systems, Vapor Compression cycles,Vapor Absorption system, Refrigerants, Expansion devices, Condenser and evaporator, Psychometric process.

Other miscellaneous topics related to mechanical engineering course.