

Department of Mechanical Engineering
Ph.D. Entrance Exam Syllabus – 2022

Heat-Transfer - One dimensional heat conduction, modes of heat transfer, heat transfer through fins, resistance concept & electrical analogy, lumped parameter system, unsteady heat conduction, dimensionless parameters in free and forced convective heat transfer, thermal boundary layer, heat transfer correlations for flow over flat plates and through pipes, heat exchanger performance, effect of turbulence, LMTD & NTU methods; Stefan-Boltzmann law, radiative heat transfer,

Fluid Mechanics - Fluid statics, properties, buoyancy, stability of floating bodies, forces on submerged bodies, control-volume analysis of mass, fluid acceleration, momentum and energy, differential equations of continuity and momentum, dimensional analysis, Bernoulli's equation, viscous flow of incompressible fluids, elementary turbulent flow, boundary layer, flow through pipes, bends and fittings and head losses in pipes

Thermodynamics - Properties of pure substances, thermodynamic systems and processes, the behaviour of ideal and real gases, calculation of work and heat in various processes, zeroth and first laws of thermodynamics, the second law of thermodynamics, thermodynamic relations and thermodynamic property charts and tables, availability and irreversibility.

Strength of Materials-Stress and strain concepts, axial load, statically indeterminate axially loaded members, thermal stress, torsion, angle of twist, statically indeterminate torque-loaded members, bending, eccentric axial loading of beams, transverse shear, shear flow in build-up members, combined loadings, stress and strain transformation, deflection of beams and shafts, statically indeterminate beams and shafts.

Mechanics: Laws of motion. Transfer of force to parallel position, Resultant of planer force system. Free Body diagrams, equilibrium and its equation. Introduction, Normal shear stresses, Stress-strain diagrams for ductile and brittle materials, Elastic constants, One Dimensional loading of members of varying cross sections, Strain Energy

Design for Impact and Fatigue Loads: Impact stress due to Axial, Bending and Torsional loads. Fatigue failure: Endurance limit, S-N Diagram, Low cycle fatigue, High cycle fatigue, modifying factors: size effect, surface effect. Stress concentration effects, Notch sensitivity, fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

Casting, Forming and Joining Processes - Design of patterns, moulds and cores, Different types of castings, solidification and cooling, riser & gating design, fundamentals of hot and cold working processes, Plastic deformation and yield criteria load estimation for bulk (drawing, rolling, forging, extrusion) and sheet (deep drawing, shearing, bending),

Engineering Materials - Phase diagrams, structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

Production Planning and Control - Aggregate production planning, forecasting models, materials requirement planning and scheduling.