

Syllabus for Entrance Test for admission in Ph.D Mechanical Engineering

APPLIED MECHANICS, STRENGTH OF MATERIALS AND DESIGN :Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact. Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses. Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

FLUID MECHANICS AND THERMAL SCIENCES **Fluid Mechanics**: Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends 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. **Thermodynamics**: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle, irreversibility and availability; behaviour 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.

PRODUCTION ENGINEERING and MANUFACTURING TECHNOLOGY **Metal Casting**: Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations. **Forming**: 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. **Joining**: Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding. **Machining and Machine Tool Operations**: Mechanics of machining, 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, principles of design of jigs and fixtures, Non-conventional machining. **Welding processes** friction stir processing, friction stir welding, TIG welding, MIG welding, SAW welding and all advanced welding processes

INDUSTRIAL ENGINEERING :Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning. Inventory Control: Deterministic and probabilistic models; safety stock inventory control systems. Operations Research: Linear programming, simplex and graphical method, transportation model, assignment model, network flow models, simple queuing models, PERT and CPM. Supply Chain Management.