Ph.D. Entrance Test 2015 Syllabus for Admission to Mechanical Engineering

Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, shear force and bending moment diagrams; bending and shear stresses; torsion of circular shafts; Euler's theory of columns.

Free and forced vibration of single degree of freedom systems; critical speeds of shafts; gear trains; flywheels.

Design for static and dynamic loading; failure theories; fatigue strength and the -N diagram; Design of machine elements such as bolted, riveted and welded joints, shafts, spur gear, rolling and sliding contact bearing, brakes and clutches

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 thermodynamics cycle related to energy conversion.

Rankine, Brayton cycle with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycle. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigation, Reverse Brayton cycle; psychrometric processes.

Differential equation 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., Peltonwheel, Francis and Kaplan turbines-impulse and reaction principle, velocity diagrams.

Modes of heat transfer; one dimensional heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, application of correlations for heat transfer in laminar and turbulent flow over flat plates and through pipes; radiative heat transfer, black and grey surfaces, shape factor, network analysis; heat exchanger performance, LMTD and NTU methods.

Structure and properties of engineering materials, heat treatment, stress-strain diagram for engineering materials. 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 metalluargy.

Mechanics of maching, 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.

Basic concepts of CAM and NC programming.
Forcasting models, aggregate production planning, scheduling, material requirement planning.

Deterministic and probabilistic models; safety stock inventory control systems.

Linear programming, simplex method, transportation, assignment, simple queuing model, PERT and CPM.