

Ph D Entrance Examination Syllabus: Mechanical Engineering

Note:1 Entrance Test will be of 100 marks of 100 questions and a candidate must secure 50% marks to qualify the same. In case of SC/ST / Differently-abled candidates of Haryana State, a relaxation of 5% of 50 i.e. 2.5% will be allowed.

2. Entrance test syllabus shall consist of 50% of Research Methodology and 50% shall be of subject specific.

Section-A (Research Methodology)

Meaning of Research, Research Process and Scope of Research in various disciplines, Scientific methods of research, selecting a topic of research, Ethics in Research, Methods of data collection –questionnaire/schedule; questionnaire designing, interview and observational Methods, Primary and Secondary sources of data collection, Writing of books and research papers, report writing; pre-writing consideration, thesis writing, format of report writing, formats of publication in research journals, bibliography, referencing and footnotes, major of central tendency, Data analysis using suitable quantitative techniques with application of computers, binary system, octal and hexadecimal system

Section-B (Subject Specific: 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.