

DEPARTMENT OF MECHANICAL ENGINEERING
UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY
(A Constituted Autonomous Institute)
KURUKSHETRA UNIVERSITY, KURUKSHETRA
(Established by State Legislature Act XII of 1956)
("A++" Grade, NAAC Accredited)
(2026-27)

Syllabus for Ph.D. (Full-time) Entrance Test of Mechanical Engineering

Note: The paper will consist of 100 objective questions of 1 mark each. The questions should be uniformly distributed throughout the syllabus. Use of scientific calculators is permitted. For every wrong answer, 0.25 marks will be deducted.

Part I: Research and Methodology — 15 objective-type questions, 15 marks

Part II: Subject Specific — 85 objective-type questions, 85 marks

Time Allowed: 2 Hours Maximum Marks: 100

PART A: RESEARCH AND METHODOLOGY (15 QUESTIONS)

Statistics; mean, median, mode and standard deviation; random variables; binomial, Poisson and normal distributions,

Elementary Knowledge of MS Office:

MS Word: Creating, editing, saving and printing text documents; font and paragraph formatting; inserting tables and page breaks; working with images; using spelling and grammar check.

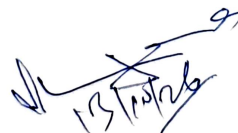
MS Excel: Creating, editing, saving and printing spreadsheets; working with functions and formulas; graphically representing data; charts and graphs.

MS PowerPoint: Opening, viewing, creating and printing slides; applying auto-layouts; adding custom animation; graphically representing data.

Introduction to Material Characterization Techniques: Basic principles of XRD, SEM, XRF and TEM techniques.


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PART B: SUBJECT SPECIFIC (85 QUESTIONS)

APPLIED MECHANICS AND DESIGN

Engineering Mechanics: Free-body diagrams and equilibrium; moment of inertia; parallel-axis theorem and perpendicular-axis theorem; concepts of impulse-momentum equation and work-energy equation; collisions.

Mechanics of Materials: Stress and strain; elastic constants; Poisson's ratio; 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; thermal stresses; testing of materials with a universal testing machine; stress-strain diagrams for engineering materials; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; gyroscope.

Vibrations: Free and forced vibration of single-degree-of-freedom systems; effect of damping; vibration isolation; resonance; critical speeds of shafts.

Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S–N diagram; principles of design of machine elements such as bolted, riveted and welded joints; shafts, gears, brakes and clutches.

FLUID MECHANICS AND THERMAL SCIENCES

Fluid Mechanics: Fluid properties; fluid statics; manometry; buoyancy; forces on submerged bodies; stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis.

Heat Transfer: Modes of heat transfer; one-dimensional heat conduction; resistance concept and electrical analogy; heat transfer through fins; thermal boundary layer; dimensionless parameters in free and forced convective heat transfer; effect of turbulence; heat-exchanger performance; LMTD and NTU methods; radiative heat transfer; Stefan–Boltzmann law; Wien's displacement law; black and grey surfaces.

Thermodynamics: Thermodynamic systems and processes; properties of pure substances; behaviour of ideal and real gases; zeroth and first laws of thermodynamics; calculation of work and heat in various processes; second law of thermodynamics.

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Applications / Power Engineering: Air and gas compressors; vapour and gas power cycles; concepts of regeneration and reheat; I.C. engines; air-standard Otto, Diesel and dual cycles.

Refrigeration and Air Conditioning: Vapour and gas refrigeration and heat-pump cycles; properties of moist air; psychrometric chart; basic psychrometric processes.

Turbomachinery: Impulse and reaction principles; Pelton-wheel, Francis and Kaplan turbines.

MATERIALS, MANUFACTURING AND INDUSTRIAL ENGINEERING

Engineering Materials: Structure and properties of engineering materials; phase diagrams; heat treatment.

Casting, Forming and Joining Processes: Different types of castings and patterns; mould and core compositions; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot- and cold-working processes; bulk deformation (forging, rolling, extrusion and drawing) and sheet-metal forming operations (shearing, deep drawing and bending); principles of welding, brazing and soldering processes.

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; principles of non-traditional machining processes; principles of workholding, jigs and fixtures.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM; part programming for CNC machines.

Inventory Control: Deterministic models; Economic Order Quantity (EOQ); safety-stock inventory-control systems.

Operations Research: Linear programming; simplex method; transportation; assignment; PERT and CPM.


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