Syllabus for PhD Entrance Test for Mechanical Engineering
Academic Session 2022-23

Unit I

Engineering Mechanics: Free-body diagrams and equilibrium; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, 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; Euler's theory of columns; energy methods

Unit II

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

Unit III

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

Unit IV

Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements.

Unit V

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

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, free and forced convective heat transfer, heat exchanger performance, radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law

Unit VI

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; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

Unit VII

Casting, Forming and Joining Processes: Different types of castings, design of patterns; solidification and cooling; 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. Principles of welding, brazing, soldering and adhesive bonding.

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; economics of machining; principles of non-traditional machining processes

Unit VIII

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry

School of Engineering & Technology

Islamic University of Science and Technology Kashmir, J&K

Syllabus for Ph.D. Admission Entrance Test 2023

Department of CE/ ECE/ EE/ CSE/ ME/ CS/ FT

Paper – I: Research Methodology for Engineering & Technology

Max. Marks: 35

Unit 1: Research Concepts & Design

Research: Meaning, Objectives and Types. Research Approaches, Research Process, and Criteria for good research. Research Problem: Selecting the Problem, Steps in formulating research problems, Techniques for problem identification. Meaning and importance of research design, Types of research design, Features of a good research design.

Unit 2: Data Collection & Analysis

Data Sources: Primary and secondary. Tools and techniques for data collection (questionnaires, interviews, observations, schedules etc.), Selection of appropriate method of data collection. Logic, Deduction, Numerical Relations & Reasoning, Data Interpretation, Data charts & graphs, 2 and 3-dimensional plots, maps, and tables. Numerical computation and estimation: ratios, percentages, powers, exponents, and logarithms, permutations and combinations, and series.

Unit 3: Statistics & Probability

Measures of Central Tendency & Dispersion: Mean, Mode, Median, Variance & Standard Deviation. Probability, Conditional Probability, Binomial Distribution, Poisson Distribution, Normal Distribution and Exponential Distribution.

Unit 4: Mathematical Aptitude

Vectors, Matrices and Determinants, Eigen Values and Eigen Vectors, Rank, Solution of Linear Equations, Maxima and Minima. Differential Equations of first order, higher order linear differential equations, analytic functions. Numerical Analysis: Interpolation, numerical solution of ordinary differential equations.

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