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Annexure 3

Syllabus for Written Test

Common Syllabus

(1) General Aptitude: Basic Mathematics, Reasoning and Aptitude: Basic geometry, Linear Algebra, Ordinary Differential Equations, Combinatorics, Probability, Analytical reasoning and aptitude

(2) Engineering Mathematics: Systems of linear equations; Eigen values and eigen vectors; Differential equations, First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Initial and boundary value problems; Laplace transforms, Numerical solutions of linear and non-linear algebraic equations, single and multi-step methods for differential equations.

Thermofluids Engineering Syllabus

(3) Fluid Mechanics: Properties and classification of fluids; fluid statics, manometry, forces on immersed bodies, buoyancy, 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; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings, measurement of flow rate and pressure drop.

(4) 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.

(5) Applications: Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycles. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes. Turbomachinery: Pelton-wheel, Francis and Kaplan turbines — impulse and reaction principles, velocity diagrams.

Solid Mechanics and Design Syllabus

(6) Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and rigid bodies, impulse and momentum and energy formulations; impact.

(7) 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.

(8) Kinematics and Dynamics of Machinery: Displacement, velocity and acceleration analysis of plane mechanisms; cam, gear trains, spatial mechanisms. Static force analysis and dynamics force analysis (planar), Dynamic force analysis (Spatial), Cam Dynamics, Balancing, Gyroscopes.

(9) Mechanical Vibrations: Free and forced vibration of single degree of freedom systems; natural frequencies, resonance, effect of damping; Vibration under General forcing conditions, vibration isolation; critical speeds of shafts, Vibration control, torsional vibration, Vibration of Distributed Systems, Numerical Integration Methods in Vibration Analysis.

Manufacturing

(10) Engineering Materials: Structure and properties of engineering materials, stress-strain diagrams for engineering materials.

(11) Metal Casting Processes: Casting Terminology, Expendable and Permanent Mould Casting Processes; Basic physics and understanding of casting shape, metal flow and solidification; Design principles for mold cavity, feeder and gating system; Casting defects and inspection of castings.

(12) Machining and Machine Tool Operations: Mechanics of machining, Single and multi-point cutting tools, Tool geometry and materials, Tool life and wear; Kinematics of machine tools; Economics of machining; Non-traditional machining processes; Abrasive and Super-finishing Processes; Principles of work holding, Principles of jigs and fixtures design.

(13) Metrology and Inspection: Limits, fits and tolerances; Linear and angular measurements; Comparators; Gauge design; Interferometry; Form and finish measurement; Co-ordinate Measuring Machine (CMM); Tolerance analysis in manufacturing and assembly.

(14) Computer Integrated Manufacturing: Fundamentals of CNC machines, CNC Programming Fundamentals, CNC Hardware, CAD/CAM Integration, Computer Aided Process Planning, Rapid Prototyping.

(15) Welding and Joining: Fundamentals of arc welding, Arc welding processes, Solid state welding processes, Gas welding.

(16) Forming Processes: Plastic deformation and yield criteria; fundamentals of hot and cold working processes; bulk deformation processes (forging, rolling, extrusion, drawing) and sheet metal processes; principles of powder metallurgy, Powder metallurgy processes.

Chairman, PG Admission, Department of Mechanical Engineering