Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Department of Mechanical Engineering Engineering

Ph. D Entrance Test

Paper 2: Mechanical Engineering

Examination Scheme
Total Marks: 100
(Multiple Choice Questions- 2 marks each)

Unit I: Applied Mechanics and Design
Mechanics of Materials - Elastic constants, Stress and strain, Poisson's ratio, thin cylinders, Mohr's circle for plane stress and plane strain, shear force and bending moment diagrams, deflection of beams, bending and shear stresses, torsion of circular shafts, energy methods, thermal stresses, testing of materials with universal testing machine, **Engineering Mechanics** - Virtual work; impulse and momentum (linear and angular), kinematics and dynamics of particles & of rigid bodies in plane motion and energy formulations, collisions. **Theory of Machines -** Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. **Machine Design** - Design for static and dynamic loading, Failure theories, fatigue strength and the S-N diagram, gears, shafts, rolling and sliding contact bearings, springs, brakes and clutches, principles of the design of machine elements like riveted, bolted and welded joints **Vibrations -** Effect of damping, Free and forced vibration of single degree of freedom systems, resonance, vibration isolation, critical speeds of shafts.
Unit II: Fluid Mechanics and Application
Fluid Mechanics - Fluid statics, properties, manometry, buoyancy, stability of floating bodies, forces on submerged bodies, control-volume analysis of mass, fluid acceleration, momentum and energy, differential equations of continuity and momentum, dimensional analysis, Bernoulli's equation, viscous flow of incompressible fluids, elementary turbulent flow, boundary layer, flow through pipes, bends and fittings and head losses in pipes Applications - Power Engineering and Turbomachinery
Unit III: Thermal Sciences-I
Heat-Transfer - One dimensional heat conduction, modes of heat transfer, heat transfer through fins, resistance concept & electrical analogy, lumped parameter system, unsteady heat conduction, Heisler's charts, dimensionless parameters in free and forced convective heat transfer, thermal boundary layer, heat transfer correlations for flow over flat plates and through pipes, heat exchanger performance, effect of turbulence, LMTD & NTU methods; Stefan-Boltzmann law, radiative heat transfer, Wien's displacement law, view factors, black and grey surfaces and radiation network analysis
Unit IV: Thermal Sciences-II

Thermodynamics - Properties of pure substances, thermodynamic systems and processes, the behaviour of ideal and real gases, calculation of work and heat in various processes, zeroth and first laws of thermodynamics, the second law of thermodynamics, thermodynamic relations and thermodynamic property charts and tables, availability and irreversibility.

Applications - I.C. Engines, Refrigeration and air-conditioning

Unit V: Materials and Manufacturing

Casting, Forming and Joining Processes - Design of patterns, moulds and cores, Different types of castings, solidification and cooling, riser & gating design, fundamentals of hot and cold working processes, Plastic deformation and yield criteria load estimation for bulk (drawing, rolling, forging, extrusion) and sheet (deep drawing, shearing, bending), principles of powder metallurgy, metal forming processes, brazing, Principles of welding, soldering & adhesive bonding.

Engineering Materials - Phase diagrams, structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

Machining & Machine Tool Operations -Basic machine tools, Mechanics of machining, single and multi-point cutting tools, tool life and wear, tool geometry and materials, the economics of machining, principles of work holding, principles of non-traditional machining processes, design of jigs and fixtures.

Computer Integrated Manufacturing - Concepts of CAD/CAM and their integration tools.

Unit VI: Measurement and Production Engineering

Metrology and Inspection - Linear and angular measurements, Limits, fits and tolerances & comparators; gauge design, interferometry, alignment and testing methods, form and finish measurement, tolerance analysis in manufacturing and assembly.

Production Planning and Control - Aggregate production planning, forecasting models, materials requirement planning and scheduling.

Operations Research - Simplex method, linear programming, transportation, network flow models, assignment, simple queuing models and PERT & CPM.

Inventory Control - Safety stock inventory control systems, Deterministic models.

B.O.S. Chairman
Department of Mechanical Engineering