Medicaps University

Syllabus for Ph. D. Entrance Exam in Mechanical Engineering

SECTION A
APPLIED MECHANICS, STRENGTH OF MATERIALS AND DESIGN
Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; kinematics and dynamics of particles and of rigid bodies in plane motion, **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; torsion of circular shafts; Euler's theory of columns; thermal stresses. Theories of Failure, Fatigue failure, S-N curve, Fracture criterion, Fracture toughness, Engineering materials; Iron- Carbon Diagram. **Theory of Machines:** Degree of Freedom, Displacement, velocity and acceleration analysis of plane mechanisms; gears and gear trains; flywheels.

SECTION B
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.

SECTION C
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 achining processes; principles of work holding, principles of design of jigs and fixtures, Non-conventional machining.

SECTION D
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.

NOTE: There will be 25 multiple choice questions from this section and will

carry equal marks.