



Bhartiya Skill Development University

Syllabus for Ph.D. Entrance Test

Metal Construction

Manufacturing and Materials Engineering:

Metal Casting: Design of patterns, moulds and cores; solidification and cooling; Homogeneous and heterogeneous solidification; interpretation of solidification microstructure for pure metals and alloys from the phase equilibrium diagram and TTT diagram; casting defects; riser and gating design considerations. **Forming:** Theory of Plastic deformation and yield criteria; Strengthening Mechanisms; fundamentals of hot and cold working processes; microstructure development during hot and cold working; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending); softening in metals after cold working (recovery, recrystallization and grain growth phenomena). **Joining:** Physics of welding; Welding Metallurgy of Ferrous and non-ferrous materials; types of fusion and solid-state welding processes; 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 machining processes; principles of work holding, principles of design of jigs and fixtures, Non-conventional machining. **Powder Metallurgy Processes:** Powder preparation processes for both metal and ceramic; compaction; liquid phase and solid state sintering. **Failure Analysis:** Corrosion failures, Fatigue failures, Wear failures, Creep failure. **Heat Treatment of Ferrous and Non-ferrous materials.**

Mechanics and Design:

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact. **Strength of Materials and Design:** 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; Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches; Von-Mises criterion of Failure.