

राष्ट्रीय प्रौद्योगिकी संस्थान, श्रीनगर
धात्विकी एवं पदार्थ अभियांत्रिकी विभाग
National Institute of Technology Srinagar
Metallurgical and Materials Engineering Department



Syllabus for the PhD Entrance Exam (Autumn-2026)

Part A: Department Core Syllabus

1. **Introduction to Metallurgy and Engineering Materials:** Introduction to Metallurgy; Classification of engineering materials based on their properties - metals, polymers, ceramics, composites, and advanced materials; Important ferrous and non-ferrous materials.
2. **Metallurgical Thermodynamics and Kinetics:** First law – energy conservation, Second law - entropy; enthalpy, Gibbs and Helmholtz. free energy; Maxwell's relations; chemical potential; applications to metallurgical systems. Basic Laws of Chemical Kinetics: First order reactions; reaction rate constant; Arrhenius relation; heterogeneous reactions; oxidation kinetics.
3. **Physical Metallurgy:** Atomic bonding in solids, Crystal structure of metals, crystal imperfections; Phase rule and phase diagrams (Binary systems); Heat treatment of steels like annealing, normalising, hardening, tempering and hardenability, etc.; Time-Temperature-Transformation (TTT) and Continuous Cooling Transformation (CCT) diagrams of steels; precipitation hardening & ageing; Diffusion in solids, Ficks law of diffusion; Solidification; Various characterisation techniques used for microstructural analysis.
4. **Mechanical Metallurgy:** Stress; Strain; Mechanical Behaviour of Materials – tensile, compression, fracture, creep, and fatigue; Dislocation Theory.
5. **Extractive Metallurgy:** Principles and extraction of important ferrous and non-ferrous metals.
6. **Manufacturing Processes:** Metal casting; Bulk deformation processes; Sheet metal forming processes; Welding; Manufacturing defects. Powder Metallurgy– Production of powders, compaction and sintering, Surface engineering and tribology
7. **Corrosion:** General principles and types of corrosion – advantages and disadvantages; Corrective measures.
8. **Nanotechnology:** Introduction to nanotechnology, its significance, and applications; Manufacturing techniques.

Part B: Aptitude

1. **Verbal aptitude:** Basic English grammar, tenses, articles, adjectives.
2. **Quantitative aptitude:** Data interpretation, data graphs, numerical computation and estimation, permutation and combination.
3. **Analytical Reasoning:** Deduction and analogy, numerical reasoning.

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