**Syllabus of the written test for PhD admission (in the Department of Metallurgical and Materials Engineering)**

Basic knowledge in Metallurgical and Materials Engineering is expected from the candidate. For the simplicity of candidates, some of the key topics (as part of the syllabus) are given below. However, some of the questions in written test may be from the syllabus of B.Tech./M. Tech. programs of above discipline.

Unit-1

Basics of physical and mechanical metallurgy: crystal structure, phase diagram, strengthening mechanisms in solids, engineering stress-strain curve, true stress – strain curve, factors affecting tensile properties, tensile testing machines, hardness Testing machines, ductile - brittle transition behaviour and its significance, fatigue testing – S-N curves, mechanisms of fatigue in metals, factors affecting fatigue properties, creep testing – typical creep curve, mechanisms of creep deformation in metals, factors affecting creep behaviour, applications of metals, ceramics, composites and Polymers.

Unit-2

Basics of extractive metallurgy: calcination, roasting, smelting, refining processes, free energy-temperature diagrams (Ellingham diagrams) for the formation of oxides, sulphides, and chlorides and their applications, pearlitic, bainitic and martensitic transformations. Basics of powder metallurgy: mechanical alloying process, sintering phenomena and mechanisms involved. Basics of foundry technology: mold, pattern and core, materials used to prepare them, different casting practices, mold and casting defects, remedies.

Unit-3

Corrosion and protection: forms of corrosion- Galvanic, Crevice, Pitting, intergranular, stress corrosion cracking, corrosion fatigue, hydrogen embrittlement. Importance, properties and application of organic coatings and metallic coating.

Unit-4

Material characterization: Basic principle and applications of X-ray diffraction, scanning electron microscope, transmission electron microscope (TEM), selected area electron diffraction (SAED), Energy dispersive spectroscopy, dilatometry.

*Following are some suggestive books:*


1. Materials Science and Engineering: An Introduction - William D. Callister, Jr.
2. Materials Science and Engineering: A First Course - by V. Raghavan
3. Physical Metallurgy: Principles and Practices - by V. Raghavan
4. Testing of Metallic Materials by A.V.K. Suryanarayana