

**NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA**  
**DEPARTMENT OF METALLURGICAL & MATERIALS ENGINEERING**

**Ph.D./M.Tech. (Research) Selections: 2022-23**

**Syllabus for the written test**

**Foundations of Materials Science and Engineering**

The electronic structure of atoms; Types of atomic and molecular bonds; ionic bonding; covalent bonding; metallic bonding; secondary bonding; mixed bonding; hybridization; Energy bands in metals, insulators and semiconductors; Basic crystallography; Defects and dislocations; Laws of thermodynamics; heat capacity; entropy; free energy; Types of Materials: Polymers, metals and alloys, semiconductors, ceramics, composites; Diffusion; Phase rule and phase diagrams; Properties: optical, magnetic, mechanical, electrical, thermal; Corrosion and material degradation; Characterization tools: XRD, SEM, TEM, DSC, TGA, basics of spectroscopy.

**References**

1. W.D. Callister Jr, Materials Science and Engineering, Wiley, 2006.
2. W.F. Smith et al, Materials Science and Engineering, Tata McGraw Hill, 2008.
3. D.R. Askeland, W. J. Wright, Essentials of Materials Science and Engineering, Cengage, 2013.
4. V. Raghavan, Materials Science and Engineering: a First Course, PHI, 2011.
5. D.A.Skoog, F.J.Holler and T.A Nieman, Principles of Instrumental Analysis, 4<sup>th</sup> Edn. Harcourt, 2001.
6. David R Gaskell, Introduction to Metallurgical Thermodynamics, 5<sup>th</sup> Edn, CRC press, 2008.