PMT3I101 SCIENCE AND ENGINEERING OF MATERIALS

Module-I

Bonding in Solids: Ionic, Covalent, and Metallic bonding, bonding forces and energy, secondary bonding.

Crystal Structure: Space lattices and Bravais lattices, Miller Indices of planes and directions, slip planes and slip directions, stereographic projections.

Selected crystal structures: Pure metals, Diamond and Graphite, coordination in ionic crystals, AB type compounds, Silica, Alumina, Complex Oxides, Silicates. Inorganic glass: Network structure in glasses. Polymeric structures: Thermo plastics, Elastomers, Thermosets, crystalinity in polymers.

Module-II

Principles of Alloy theory: Primary substitutional solid solution, Interstitial solid solution, types of intermediate phases, Ordered-Disordered phenomena. Hume Rothery Rules, Intermetallic compounds, Normal valency compounds, Electron compounds, Interstitial compounds.

Imperfections: Point defects, Vacancies, Interstialcies, Dislocations; Edge & Screw dislocations; Burgers vector. Crystallization from the melt:

Freezing of a pure metal, plane front and dendritic solidification at a cooled surface, formation of cast structure, gas porosity and segregation, directional solidification.

Module-III

Binary Phase Diagrams: Isomorphous, Eutectic, Peritectic, Eutectoid, Monotectic and Syntectic systems, Phase rule and Lever rule. Iron-Cementite Equilibrium diagrams and its applications, Plain carbon and alloy steel, Industrial applications of steels.

Diffusion: Fick's First and Second law of diffusion, Atomic model of diffusion, Grain boundary, surface and thermal diffusion, Kirkendall Effect, Interstitial diffusion.

Nucleation: Homogeneous and Heterogeneous nucleation, Kinetics of nucleation, Growth and overall transformation kinetics.

Books for reference:

1. V. Raghavan, Materials Science and Engineering, Prentice-Hall of India Private Limited,2003.
2. W. F. Smith, Mc Graw Hill, Principles of Materials Science and Engineering, New York,1994.
3. R. E Reid Hill, Physical Metallurgy Principles, PWS-Kent Publishing,2004.
4. Vijendra Singh, Physical Metallurgy, Standard Publisher,2008.
5. C.Daniel Yesudian and D.G.Harris Samuel, Scitech Publication,India-2010
6. W. D. Callister, Materials Science & Engineering, An Introduction, John Wiley & Sons,2007.
7. L. H. Van Vlack, Addison Wisley, Elements of Materials Science and Engineering, New York, 1985.
8. M.S.Vijaya and G.Rangarajan Mc Graw Hill Education(India)-2014