MTPC2002 SCIENCE & ENGINEERING OF MATERIALS (3-0-0)

MODULE-I (08 hrs)

Bonding in solid: Ioning, 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, Silicate, Inorganic glass; Network structure in glasses, polymeric structures: Thermoplastics, Elastomers, crystallinity in polymers.

MODULE-II (08 hrs)

Principles of Alloy theory: Primary substitutional solid solution, Interstitial solid solution, types of intermediate phase, Ordered-Disordered Phenomena. Hume Rothery Rules, Intermetallic compounds, Normal valency compounds, Electron compounds, Interstitial compounds.
Imperfections: Point defects, Vacancies, Interstitial defects, Edge and Screw Dislocations, Burger's vector, Crystallization From the melt: Freezing of pure metal, plane front and dendritic solidification at a cooled surface, formation of cast structure, Gas porosity and segregation, directional solidification.

MODULE-III (08 hrs)

Binary Phase Diagrams; Isomorphous, Eutectic, Peritectic, Eutectoid, Monotectic and Syntectic system, Phase rule and Lever rule. Iron-Cementite Equilibrium diagrams and its application, Plane carbon and alloy steel, Industrial application of steels.

MODULE-IV (08 hrs)

Diffusion: Fick's First and Second law of diffusion, atomic model of Diffusion, Grain boundary, Surface and thermal diffusion Kirkendall effect, Industrial diffusion.

MODULE-V (08 hrs)

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

Books:

- Introduction to Physical Metallurgy by Avner, Tata McGraw Hill
- Materials Science and Engineering by W.D.Callister, Wiley and Sons Inc.
- Physical Metallurgy: Principles and Practice by Ragahvan, PHI.