

3 rd Semester	RMM3C001	Science and Engineering of Materials	L-T-P 3-0-0	3 CREDITS
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Module-I (10 Hours)

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, crystallinity in polymers.

Module-II (10 Hours)

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, Interstitial defects, 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 (9 Hours)

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.

Module-IV (8 Hours)

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

Module-V (8 Hours)

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

Books:

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


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