

PMM101: STRUCTURE AND PROPERTIES OF MATERIALS

L	T	P	Cr
3	1	0	3.5

Course Objective(s): To understand the classification of various engineering materials, Chemical bond characteristic; the crystalline, non- crystalline materials and different types of crystal structures and their defects. Also, to understand the concept of phase and different type of phase diagrams.

Materials Classification: Engineering materials and their classification: metals/ ceramics /polymers, Structure-property-processing co-relationship as a theme of materials science, Different levels of structures. Material Properties: Mechanical, electrical, thermal, dielectric, semi-conducting properties of materials.

Bonding in Solids: Primary and secondary bonds, Mixed bonding, Potential energy vs bond length criteria, Concept of bond length and nature of bonding Madelung energy, Variation in materials properties with bonding character.

Structure of Solids: Crystal structure, Space lattice, Bravais lattice and reciprocal lattice concept; Miller Indices of directions and planes for cubic and hexagonal system; Metallic, ionic and covalent solids; Crystal structures of NaCl, CsCl, Diamond cubic, Zinc Blende, Wurtzite, Rutile, Fluorite, Fullerenes, Spinel, Perovskite etc.,

Non-crystalline Structures: General features and classification, Structure and properties of metallic glass and amorphous semiconductors.

Crystal Imperfections: Point imperfections, Burger vector, Dislocations (edge and screw) and Surface imperfections,

Phase Diagrams: Phase rule and phase diagrams, Solid solutions, Hume Rothery rules, Intermediate phases and compounds, Unary and binary systems, Isomorphous and eutectic systems, Lever rule, Various phase reactions, Introduction to different phase diagrams, Ternary system, cooling curve and its use for drawing phase diagrams, Zone refining.

Course Learning Outcomes (CLO):

Student will be able to understand:

1. Different type of materials, and their structure.
2. Structural dependence of properties.

Recommended Books:

1. *Smallman, R.E., and Bishop, R.J., Metals and Materials, Butterworth-Heinemann, Oxford University Press (1995).*
2. *Raghvan, V., Materials Science & Engineering, PHI (1998).*
3. *Callister, W.D., Materials Science & Engineering: An Introduction, Wiley & Sons (2001).*
4. *Smith, W., Principles of Materials Science and Engineering. McGraw Hill (1990).*