

SOLID STATE PHYSICS

Code	Credits -6	Hours-6
Category: Part IIIa/Theory/Core	Semester: VI	Year of Implementation: 2023-24 onwards
Unit No. & Content	COs	Level
Unit I: CRYSTAL PHYSICS Crystalline and amorphous solids - crystal lattice - Seven crystal systems and Fourteen Bravais lattices - Miller indices – reciprocal lattice – Bragg's law -X ray diffraction - Laue, rotating crystal, and powder methods	CO1 to CO5	K1 to K5
Unit II: BONDING AND DEFECTS IN SOLIDS: Types of Bonds in Solids – Primary and Secondary bonding – Binding energy – Ionic Bonding - Born Heber Cycle- Covalent Bonding – Directionality - Hybridization - Defects in solids - Point, line, surface, and volume defects. -Crystal of compounds - AX, AX ₂ , A ₂ X ₃ types of compounds.	CO1 to CO5	K1 to K5
Unit III: ELECTRONIC AND DIELECTRIC MATERIALS: Classical Free electron theory in metals (Drude model) - success and failure of free electron theory - Quantum free electron theory – free electron gas in one dimension - Fermi energy - Fermi Dirac distribution Electric dipole moment, Polarization, dielectric constant, electric susceptibility, and polarizability – Dielectric in DC fields – types of polarization – Dielectric in AC fields – Dielectric losses – Dielectric breakdown – Super ionic conductor and its types.	CO1 to CO5	K1 to K5
Unit IV: MAGNETIC MATERIALS Classification of magnetic materials (dia, para, ferro, antiferro, and ferrimagnetic materials) – classical (Langevin) theory of diamagnetism and Para magnetism – Weiss theory of ferromagnetism – concept of domain and Hysteresis -Hard and soft Magnetic materials - superconductor- Meissner effect – Type I & Type II superconducting materials – critical field and critical temperature – BCS Theory.	CO1 to CO5	K1 to K5
Unit V: POLYMERS Molecular weight of polymers - Osmotic pressure, viscosity, and light scattering methods- Polymer classification based on crystalline nature, thermal behaviour, structural shapes of polymer molecules and monomer arrangements - Thermal transitions in polymers - Conducting Polymers and its applications.	CO1 to CO5	K1 to K5

Prescribed Books/Textbooks

1. V. Raghavan, Materials Science and Engineering First Course, 5th edition, prentice Hall (India) Ltd., (2004).
2. S. O. Pillai, Solid State Physics, New Age International Publishers, (2009).
3. P.K. Palaniswamy, Materials Science & Engineering., Scitech Publications (India) Pvt Ltd., (2011).
4. Manas Chanda, Science of Engineering Materials Vol.1&2, LCUE edn.:(Low-cost university Edition (1979).
5. R. S. Khurmi, R.S Sedha , Materials Science 2nd Edition , S. Chand & Co. ltd.,(1989).

References

1. C. Kittel, Solid State Physics – 5th edition, Wiley Eastern Ltd.
2. Charles D. Hodgman, Robert C. Weast and Samuel M. Selby, Hand Book of Chemistry and Physics 85th edition (2005), The Chemical Rubber Publishing Co, Cleveland (1960).
3. A. J. Dekker, Solid State Physics – Macmillan and Co. Ltd.
4. M. A. Wahab, Solid State Physics – Structure, Properties of Materials – Narosa Publishing house Pvt. Ltd, 2005.
5. David W. Richerson, Modern Ceramic Engineering: Properties, Processing and use in design (Third edition), Engineering Materials, CRC Press, 1992.

Suggested Readings

1. R.P. Feynman, R.B. Leighton and M. Sands, The Feynman Lectures on Physics (1989) Narosa Publishing House Addison, Wesley Publishing Company (1969).
2. Robert Resnick and David Halliday – Physics Part I and II, Wiley Eastern Private Limited, New Delhi (1969).
3. C. M. Kachhava, Solid State Physics, Tata McGraw Hill Co. (1990)