Subject Code : P8AP7

CORE COURSE VII - MATERIALS SCIENCE

Unit-I: Crystal Structure and Defects

Bonding of solids - crystal structure- NaCl, CsCl and ZnS-Reciprocal lattice-Method of Determining crystal structure – X ray Diffraction – Electron Diffraction – Neutron Diffraction – Structure Determination – Imperfection in crystals – Point defects – Line imperfection – Burger vector

Unit –II Crystal Growth and Nucleation

Nucleation and thermodynamics of crystal growth – Theories of crystal growth – Volume theory – Kossel Theory – Bravais theory – BCF theory – Low temperature solution growth – Evaporation method –Gel method – Melt method – Bridgmann method – Czochralski crystal pulling technique – Chemical Vapour transport method

Unit-III: (a) Mechanical Properties

Strength _Elasticity- Plasticity- Ductility- Malleability-Toughness- Hardness-Testing of Materials- Non-destructive Tests –Radiographic –Photo elastic and Ultrasonic methods of testing –Methods of Hardness Testing –Mechanism of deformation –Griffth's theory of fracture.

(b) Alloys:

Ceramics and glasses – cement and concrete- organic polymers composite materials.

UNIT-IV Electrical Properties of Materials

Properties of Metals-Free electron Gas- Free electron theory-Zone theory of solids-Classification of conductors, insulators and semiconductors based on Zone theory-one dimensional Brillouine Zones –construction-Variation of electrical conductivity with temperature-Fermi level-carrier concentration of Intrinsic semiconductor-Barrier potential across PN Junction-Junction properties rectifier equation-Hall effect, Hall mobility, Experimental Determination of Hall coefficient, Dielectrics-Types of Polarizability-Clausius-Mosotti relation.

Unit-V- Nonlinear optical materials

Wave propagation in an anisotropic crystal – Polarization response of materials to light – Harmonic generation – Second harmonic generation – Sum and difference frequency generation – Phase matching – Borates - Urea, Thiourea complex.

Books for study

1. Kittel, C Solid State physics, Wiley and Sons, New York, (1983). (Unit I, III)
2. P.Santhanaragavan, P.Ramasamy, Crystal Growth Processes and Methods, KRU Publications, Kumbakonam, (1998). (Unit II)
3. Gupta, Kumar Solid State Physics, S. Chand & Co., New Delhi, (1983) (Unit IV)
4. B. B. Laud, Lasers and Nonlinear Optics, 2nd edition, New Age International (P) Ltd., New Delhi, 1991.

Books for reference

1. M.Wilson, K. K. G. Smith, M. Simmons, B.Ragase, Nanotechnology, Overseas Press India Pvt., Ltd., New Delhi, First Edition, (2005).
2. Hajra and Chowdhry, Material Science and Process, India Book Distribution Co., New Delhi (2001)