

MATERIAL SCIENCE

UNIT – I : Materials Science:

Classification of materials – Engineering requirements of materials – Material structure.

UNIT – II : Bonds in Solids.

Types of Bonds and their energies – Bond formation mechanism – Ionic bond – covalent bond – Metallic bond – comparison of bonds (Dispersion bonds, Dipole bonds and Hydrogen bonds).

Crystal Imperfections – Types of imperfections – Thermal vibrations – point, line and surface imperfections – Frank Read source.

UNIT – III : PHASE DIAGRAMS.

Basic terms – solid solutions – Hume – Rothery's rules Intermediate phase – phase diagrams – Gibb's phase rules. Time – Temperature cooling curves – construction of phase diagrams – the Lever rule – eutectic systems – eutectoid systems – peritectic and Peritectoid systems – Ternary equilibrium diagram.

UNIT – IV : Phase Transformation.

Rate of Transformation – Nucleation (Homogeneous Hetrogeneous) – Nucleation and growth – Applications of phase transformations – Micro constituent of iron – carbon system - the allotropy of iron – Iron – carbon equilibrium diagram - formation of Austenite – TTT diagram – transformation of Austenite upon continuous cooling.

UNIT – V : Electron theory of metals.

Fundamental theories of electrons (Drude and Lorentz theory and Sommerfeld free electron theory) – Electron energies in a metal – zone theory of solids – energy gaps – Density of states – Zones in conductors, insulations and semi conductors – Factors affecting electrical resistance of materials.

UNIT – VI : Electrical and magnetic properties of materials.

Resistivity – Conductivity – Semi-conductors – classification of semi-conductors on the basis of Fermi energy and Fermi level – Insulators – Dielectrics – Ferro electricity – Electro striction – Piezo – electricity – Uses of Dielectrics – Capacitor Dielectric strength – Magnetic properties classification – magneto striction – Magnetic Domain – Soft and Hard magnetic materials.

Books for Reference:

1. Materials Science and processes in SI units – S.K.Hajra Choudhury – Indian Book distributing company.
2. Materials Science – G.K.Narula; K.S.Narula; V.K.Gupta – TATA MC Graw Hill.