SEMESTER - III

Paper - I : Material Science - I

Max. Marks: 55
Time: 3 Hrs

Note: Nine questions will be set and students will attempt 5 questions. Question No. 1 will be compulsory consisting of 4 parts based on the conceptual aspects of the whole syllabus. The answers should not be in yes/no. In addition to Question No. 1 there will be four Units in the question-paper each containing two questions belonging to four Units in the syllabus. Students will select one question from each unit.

UNIT - I

Crystal Structure and Mechanical Properties: Diffraction Theory and intensities, Unit cell contents, Determination of atomic arrays, reciprocal lattice (The powder and single crystal and method of diffraction).
Crystal imperfections : Point defects, Frankel and Schottky defects, line defects, slip planes and slip directions, Edge and Screw dislocation, Burgers' vector, cross-ship, slide and climb, jogs, dislocation energy, Planar defects.

UNIT - II

Mechanical Properties : Stress - strain curve true stress and true strain, Elastic deformation, Atomic mechanism of Elastic deformation, Anelastic, viscous and plastic deformation, plastic deformation by slip, stress to move a dislocation and effects of temperature, work - hardening, strengthening from grain boundaries, Solid solution strengthening, Precipitation strengthening.
Creep : Mechanism of creep, creep resistant materials, Fracture, Ductile, fracture, Brittle fracture, fatigue fracture.

UNIT - III

Dielectrics and Ferroelectrics : Maxwell's equation, Polarisation, Depolarisation field E_1, Lorentz field E_2, Field of dipoles inside cavity E_3, dielectric constant and electronic polarisability, Structural phase transitions, classification of ferroelectric crystals, polarization catastrophe.

UNIT - IV

Displacive transitions : Soft optical phonons,Landau theory of the phase transition, First order and second order transition, Antiferroelectricity, Ferroelectric domains, Piezoelectricity, Ferroelectricity.
Barium titanate above curie temperature, Theory of sponstaneous polarisation of $BaTiO_3$.

References

1. Introduction to Solids - L.V. Azaroff.
2. Materials Science - J. C. Anderson et al
3. Introduction to Solid State Physics - C. Kittle (VI Ed. 1997).
4. Solid state physics - N.W. Ashcrofts and N.D. Mermin.