SARDAR PATEL UNIVERSITY
Programme & Subject: M.Sc (Physics)
Semester: IV
Syllabus with Effect from: June - 2014

Paper Code: PS04EPHY02	**Total Credit: 4**
Title Of Paper: Crystal Growth & Imperfections in Solids	

Unit	Description in detail	Weightage (%)
I	Phases equilibrium diagrams: phase rule and equilibrium, cooling curves, solid solution equilibrium diagrams, the Lever rule, Eutectic systems, Peritectic equilibrium diagram, layer type equilibrium diagrams. Nucleation, classical theory of nucleation, Gibb's – Thomson equation for vapour, melt and solution, homogeneous and heterogeneous nucleation, Crystal growth techniques – Bridgman- basic process, Crystal pulling method, Vernueil flame fusion process, float zone process, solution growth: slow cooling process at low and high temperature, growth in gels, flux growth, vapour transport.	25%
II	Point imperfections: vacancy and interstitial, concentration of point imperfections, line imperfections : edge, screw, Burger's vector, Burger's circuit, presence of dislocations , dislocation motion, slip planes and slip directions, dislocation reaction Surface imperfections : grain boundary, tilt and twist boundary, stacking faults: stacking faults in fcc crystals, stacking faults in hcp crystals.	25%
III	Experimental techniques for observation of dislocations :surface method , decoration method, electron microscopy, X-ray diffraction topography, field ion microscopy, cross-slip, velocity of dislocations, Stress field of a dislocation, strain energy of a dislocation ,forces on dislocation, forces between dislocations, multiplication of dislocations : Frank-Read Sources, multiple cross glide , Types of colour centres- F, R, M and V centers, production of colour centres.	25%
IV	Diffusion- introduction, Diffusion mechanisms, steady state diffusion, non-steady state diffusion, factors that influence diffusion- composition and temperature, some applications of diffusion : measurement of diffusion coefficient, Carburizing and Decarburizing process in steel, random walk treatment of diffusion, Kirkendall effect, diffusion in alkali halides,. Fundamentals of fracture, ductile fracture, brittle fracture, stress concentration, Fatigue, cyclic stresses, the S-N curve, Creep- generalized creep behaviour, stress and temperature effects, data extrapolation method, Hardness, Rockwell hardness tests, Brinell Hardness tests, Knoop and Vicker's microhardness tests.	25%

Basic Text & Reference Books:-

- Crystal growth processes by J. C. Brice
- The Physics of engineering solids by T. S. Hutchison and D.C. Baird
- Crystal growth: Processes and Methods by P. Santana Raghavan and P. Ramasamy
- Solid State Physics by M.A. Wahab
- Materials science and Engineering an introduction by William D. Callister. Jr.
- Introduction to Solid State Physics by Charles Kittel.

- Principle of Solid State Physics by F. Levy
- Elements of Solid State physics by J.P. Srivastava
- The nature and properties of Engineering Materials by Zbigniews. D. Jasterzzebski.
- Introduction to dislocation by D. Hull
- Elementary Solid State Physics by M.A. Omar