

Course No.	Course Name	L-T-P-Credits
CY 538	Solid State Chemistry	3-0-0: 03
Prerequisite: NIL		
Course Objectives:	The main objective of the course is to provide an introduction to the concepts underlying solid-state chemistry. The course will be useful for the students to illustrate the wide range of materials and their physical properties that currently available.	
Course Outcomes:	After successful completion of the course, students will be able to: <ol style="list-style-type: none"> 1. Provide a qualitative description of crystal structures and bonding in solid materials. 2. Define solid-solid phase transition based on thermodynamic, kinetic and structural characteristics of a phase transition and knowledge of some of the most important phase transition in inorganic functional materials 3. Give a qualitative and quantitative representation of 0, 1 and 2-dimensional defects in solids and acquire knowledge of defects related to non-stoichiometry in some important classes of inorganic materials. 4. Understand the structure-property relationship of materials. 	
SYLLABUS		
Module	Contents	Hours
I	Introduction to Crystals and Lattices Unit cells, crystal structure, packing, packing efficiency, coordination number, density of packing in simple cubic, BCC CCP, and HCP structure, tetrahedral, and octahedral holes, radius-ratio, Lattice energy. Structures of Rock salt, zinc blende, Wurtzite, rutile and calcite, perovskite and spinels.	06
II	Crystal Defects and Non-Stoichiometry Perfect and imperfect crystals, intrinsic and extrinsic defects - point defects, line and plane defects, vacancies - Schottky defects and Frenkel defects, thermodynamics of Schottky and Frenkel defects formation, colour centres, non-stoichiometry and defects.	04
III	Solid State Synthesis General principles, experimental procedures, high temperature methods, co-precipitation as a precursor to solid state reactions, sol-gel methods, microwave synthesis, high pressure methods for synthesis of solids, kinetics of solid state reactions.	08
IV	Phase Transformations in Solids Classification and thermodynamics of phase transformations in solids, first order and second order phase transitions, applications of	04

	G-T diagrams, kinetics of phase transformations, nucleation and growth mechanism, experimental methods of study of phase transformations. Phase transformation in metals, alloys and compounds.	
V	Band Structures of Solids Band structure of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions.	06
VI	Properties of Solid Optical properties: Optical reflectance, photoconduction - photoelectric effects. Superconductors and electrically conducting solid, organic charge - transfer complex, organic metals, and magnetic properties - classification of materials. Quantum theory of paramagnetics - cooperative phenomenon, magnetic domains, hysteresis, dielectric, ferroelectric and piezoelectric properties of solids.	08

Essential Readings:

1. L. E. Smart and E. A. Moore, "Solid State Chemistry: An Introduction", CRC Press, 4th Edition, 2012.
2. A. R. West, "Solid State Chemistry and its Applications", Wiley 2nd Edition, 1999.

Supplementary Readings:

1. C. N. R. Rao, "New Directions in Solid State Chemistry", Cambridge University Press, 2nd Edition, 1997.