Programme: M. Sc. Part-II (Chemistry)
Course Code: PCO-501
Title of the Course: Solid State Chemistry I: Concepts and applications
Number of Credits: 03 **Effective from AY:** 2019-20

Prerequisites for the course:	Students should have studied the course PCC 401, PCO 401 in M.Sc. I. so as to have basic knowledge of material chemistry and reaction kinetics.	
Course Objectives:	1. To introduce concepts of solid state science 2. To provide fundamental knowledge of solids, description of crystal chemistry and classification of crystal structure and significance of crystal defects. 3. To provide basic understanding of temperature dependence of crystal structure, phase modifications and its influence on magnetic and electric properties of solids	
Course Outcomes:	1. Students should be in a position to understand the concept of solid state synthesis. 2. Students should be able to identify different solids based on crystal structure 3. Students should be in a position to understand the significance of crystal structure and its modifications, so as to enhance the magnetic and electrical properties to suit energy applications.	
Content:	**1. Solid State: Introduction** 1.1 General Principles and experimental procedure. 1.2 Hydrothermal and thin film method in solid state synthesis 1.3 Kinetics of solid state reactions, ion exchange and intercalation reactions. **2. Crystal Chemistry:** 2.1 Unit Cells, close packed structures-ccp and hcp. 2.2 Ionic structures and covalent networks. 2.3 Some important structure types – rock salt, zinc blende, wurtzite, nickel arsenide and rutile. 2.4 Factors that Influence Crystal Structures: valencies and coordination numbers. 2.5 Significance of radius ratio rule and non-bonding electron effects. **3. Crystal Defects and non stoichiometry:** 3.1 Types of defects. Point defects and thermodynamics. 3.2 Colour Centres, vacancies and interstitials in non stoichiometric crystals. 3.3 Dislocations, mechanical properties and reactivity of solids. **4. Symmetry, Point Groups and Space Groups:** 4.1 Symmetry, miller Indices, lattice planes, d-spacings and multiplicities 4.2 Representation of point groups and space groups **5. Phase Diagrams and Phase Transitions** 5.1 Basic Concepts and definitions. 5.2 Three component condensed systems. Martensitic	5 hours 10 hours 5 hours 4 hours 4 hours

	transformations. Order-disorder transitions. **6. Ionic Conductivity and Solid Electrolytes:** 6.1 General Introduction 6.2 Conduction in NaCl and AgCl 6.3 DC and AC resistivity measurements **7. Electronic Properties and Band Theory** 7.1 Electronic structure and band theory of solids. 7.2 Band structure of metals and semiconductors. 7.3 Magnetic properties of transition metal oxides and applications	4 hours 4 hours
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	1. A. R. West, *Solid State Chemistry and Its Applications,* John Wiley & Sons 2003. 2. H. V. Keer, *Principles of the Solid State,* New Age International Publishers, 1993.	