

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICC-502

Title of the Course: Materials Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICC-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of Materials Chemistry	No. of Hours
Course Objective:	To provide basic and advanced knowledge about solid state chemistry	
Course Outcome	This course will give sufficient information about the preparation of different types of materials, their structures, reactivity and properties.	
Content:	<p>1. Introduction to Materials chemistry</p> <p>2. Structure and bonding in solid materials: Crystal lattice; unit cell; Miller indices and planes; X-ray diffraction method; metallic, covalent and ionic solids; structural classification of binary and tertiary compounds.</p> <p>3. Non-stoichiometry in material solids: Oxygen deficient oxides, metal deficient oxides and classification of non-stoichiometry.</p> <p>4. Crystal defects: Types of defects: Point defects; Dislocations: Line defects and Plane defects</p> <p>5. Materials preparation techniques: I) Ceramic method II) Different wet chemical methods: A) For Powder materials: Co-precipitation, Precursor, Combustion, Sol-gel, Spray roasting, Freeze drying. B) For Single crystals: i) Growth from melt ii) Flux method iii) Epitaxial growth of single crystal thin films: Chemical and Physical methods iv) Chemical vapour transport v) Hydrothermal method vi) Dry high pressure method. C) For Amorphous Materials D) For Nanomaterials</p> <p>6. Reactivity of Solid Materials: Tarnish reactions, decomposition reaction, solid-solid reactions, addition reactions, double decompositions reaction, electron transfer reaction, solid-gas reactions, sintering, factors influencing reactivity of solids.</p> <p>7. Phase Transformations in Solid Materials: Thermodynamic consideration, structural change in phase transformation, Martensite transformation, temperature and pressure induced transformations, order- disorder transitions,</p>	<p>1 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p> <p>7 hr</p> <p>3 hr</p> <p>3 hr</p>

	<p>electronic transition, transformation with a change in composition.</p> <p>8. Electrical Properties: Electrical conductivity, free electron theory, fermi energy, insulators, semiconductor and conductors, band theory of semiconductor, Brillouin zones, Hall effect, the Seebeck effect, Superconductivity, BCS theory, Meissner effect, high temperature superconductor.</p> <p>9. Semiconductor Devices: Diodes, transistors and Junction field effect transistor, light meter, photodiode, phototransistor, solar cells, light emitting diodes, laser materials.</p> <p>10. Optical and dielectric properties: Luminescence and phosphorescence, piezoelectric, ferroelectric materials and applications.</p> <p>11. Magnetic properties: Introduction to magnetism, behaviour of substance in a magnetic field, magnetic moments, diamagnetism, paramagnetism, experimental determinations of susceptibility, ferromagnetism, anti-ferromagnetism and ferrimagnetism.</p>	<p>4 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p>
Pedagogy:	Lectures/ tutorials/ self-study or a combination of some of these.	
Text/Reference books/ Readings	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid State Chemistry and its applications</i>, Wiley India Pvt. Ltd., New-Delhi, 2003 Ed. 2. L. V. Azaroff, <i>Introduction to solids</i>, Tata McGraw Hill, New-Delhi, 2009, 1977 Ed. (33rd Reprint). 3. N. B. Hannay, <i>Treatise on Solid State Chemistry Vol.4 Reactivity of Solids</i>, Plenum Press, New York, 1976, 1st Ed. 4. D. K. Chakraborty, <i>Solid State Chemistry</i>, New Age International Publisher, New-Delhi, 2010, 2nd Ed. 5. H. V. Keer, <i>Principles of the Solid State</i>, New Age International (P) Ltd., New-Delhi, (Wiley Eastern Ltd, New-Delhi), 1993, 1st Ed. (Reprint 2005). 6. C. N. R. Rao & K. J. Rao, <i>Phase Transitions in Solid</i>, McGraw Hill, New York, 1977, 1st Ed. 7. W. D. Callister, <i>Material Science and Engineering: An Introduction</i>, John Wiley, New York, 2007, 7th Ed. 8. B. D. Fahlman, <i>Materials Chemistry</i>, Springer, Netherlands, 2011, 2nd Ed. 9. Harry R. Allcock, <i>Introduction to materials Chemistry</i>, John Wiley & Sons, 2011, 1st Ed. 10. C. N. R. Rao & J. Gopalakrishnan, <i>New directions in solid state chemistry</i>, Cambridge University Press, Cambridge, 1997, 2nd Ed. 	