

# 20CY201 SOLID - STATE AND MATERIALS CHEMISTRY

Hours Per Week :

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## COURSE DESCRIPTION AND OBJECTIVES:

This course will be providing students with understanding the basic knowledge about various solids and their preparation methods. This course also provides various properties solids such as electrical, magnetic and optical properties. Moreover students learn about various organic and composite materials.

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

| COs | Course Outcomes   |
|-----|---|
| 1.  | Analyze various types' solids and their structures.                                     |
| 2.  | Familiarize with various synthetic methods for the preparations of solids and materials |
| 3.  | Evaluate the electrical properties of solids.   |
| 4.  | Analyze various magnetic and optical properties that exhibit by materials.              |
| 5.  | Understand various organic and composite materials.                                     |

**Unit - I :****Solids and Types**

Solids, types of solids, Crystal Structure, Crystalline solids, crystal systems, point groups. Amorphous and Crystalline Solids, Ionic Solids, Metallic Solids, Covalent or Network Solids, Organic Materials, Bio Materials

**Unit – II :****Synthesis of Solid State Materials :**

Preparation of pure materials, Solid state reaction technique, Sol-gel technique, Co-precipitation technique, Hydrothermal method, Chemical/Physical vapor deposition technique, Nucleation and crystal growth techniques.

**Unit – III :****Electrical Properties of Solids :**

Electrical conductivity and Ohm's law, Hall effect, Band theory, Band Gap, Metals and Semiconductors, Intrinsic and extrinsic semiconductors, Organic semiconductors, Hopping semiconductors, Semiconductor / metal transition, p-n junctions, Resistivity, Superconductors, Meissner effect, type I and II superconductors, Temperature dependence on carrier concentration.

**Unit – IV :****Magnetic and Optical Properties :**

Classification of magnetic materials, Diamagnetism, Quantum theory of para-magnetism, Ferro, antiferro and ferri, magnetism, Magnetic domains and hysteresis, Super, para, magnetism. Photoconduction, Photo and electroluminescence, Lasers, Photovoltaic and Photo-electrochemical effects, Organic magnetic materials

Brief Introduction to Different Classes of Materials: High  $T_c$  superconductors, Ionic conductors, Polymers, Liquid crystals, Molecular materials.

**Unit – V :****Organic Materials and Composites :**

Dyes, Chromophore structure, Synthesis of typical dyes, Solar cells, Organic photonics, Photovoltaics, Fullerenes, Ionic liquids, Thin Films, Preparation and applications, Composite materials, Organic Clay materials and applications, Nano-composites.

**Text Books :**

1. W. D. Callister, Materials Science and Engineering, An Introduction: Wiley Publishers, 10<sup>th</sup> edition, 2018.
2. Solid State Chemistry and its Applications, Anthony R. West, Wiley Publishers, 2<sup>nd</sup> edition, 2014.
3. C. Kittel, Introduction to Solid State Physics, Wiley Publishers, 2<sup>nd</sup> edition.
4. V. Raghavan: " Materials Science and Engineering a First Course" Prentice Hall of India Learning Pvt. Ltd., 5<sup>th</sup> edition, 2013.