Bachelors with Chemistry as Major/Minor
7th Semester

Title of the course: Chemistry of Materials

Course Code:CHM722J/N1**Credits:**Theory-3, Tutorial-1

Theory (3 credits: 45 Hours) **Max. Marks**: 75, **Min Marks:**27

Course Objectives:

- Introduce variety of materials to the students having significant technological importance.

Learning outcomes:

After completing this course, the student is expected to learn the following

- Properties of wide variety of materials used in electronic industries.
- Know the chemistry of the ceramcs and glasses used in our daily life.
- Know the cncept of the nanomaterials and their types alongwith their applications.

Unit I. Electric and magnetic materials (15 Hours)

Semiconductors: intrinsic and extrinsic, pn Junction, pn junction-based devices, injection laser

Superconductors: characteristic properties (zero resistance, meissner effect, heat capacity, thermal conductivity, Josephson effect. Applications of superconductors.

Dielectric materials: Dielectric constant, piezo-, pyro-, and ferroelectric materials and their applications.

Magnetic Materials: Diamagnetic, paramagnetic and ferromagnetic materials, Temperature dependence of magnetization in different magnetic materials.

Unit II. Ceramics and Glasses (15 Hours)

Ceramics:Definition and classificationof ceramics, refractories, ceramic coatings (glazed and enamels).Applications of ceramics.

Glass:Glassy state and its properties, classification (silicate and non-silicate glasses), Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Unit III. Novel Materials (15 Hours)

Liquid crystals:Mesomorphism, types of liquid crystals, molecular structural requirements of liquid crystals. Applications of liquid Crystals: Liquid crystal display (LCD), Thermography and optical imaging

Conducting polymers: Introduction and synthesis, electric and electronic properties.

Nanomaterials: Introduction, synthesis (top-down approach, bottom up approach), examples of nano structures, nano-fibres, nano wires, quantum dots, nano tubes, applications and challenges in nanoscience and technology

Tutorials (1 credits: 15 Hours) Max. Marks: 25, Min Marks:9

1. Using online videos understand the properties of superconductors and their applications; the generation of electricity by piezoelectric effect as a solution to energy requirements and hysteresis in the ferromagnetic materials with emphasis of its effect on their applications.
2. Prepare a chart indicating the composition of the variety of glasses, their properties and consequent applications.
3. Understand the design and working of LCD through construction of 8 and 16 segment cells and then extend it to the matrix cells.

Books Suggested

1. Introduction to Materials Chemistry by Harry R. Allcock, Wiley
2. Kingery, W. D., Bowen H. K. and Uhlmann, D. R. Introduction to Ceramics, Wiley Publishers, New Delhi, 1976
3. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
4. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.
5. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
6. P. C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
7. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi.
8. B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meerut
9. Lynn J. Frewer, Willehm Norde, R. H. Fischer and W. H. Kampers, Nanotechnology in the Agri-food sector, Wiley-VCH Verlag, (2011).
10. Jennifer Kuzma and Peter VerHage, Nanotechnology in agriculture and food production, Woodrow Wilson International Center, (2006).
11. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007)