

Additional Resources:

- Moore, W.J. (1972), Physical Chemistry, 5th Edition, Longmans Green & Co. Ltd.
- Glasstone, S. (1948), Textbook of Physical Chemistry, D. Van Nostrand company, New York.

Teaching Learning Process:

- Conventional chalk and board teaching,
- Class interactions and discussions
- Power point presentation on important topics.

Assessment Methods:

- Class Tests at Periodic Intervals.
- Written assignment (s) / Presentation by individual students
- End semester University Theory and Practical Examination

Keywords: Phase rule, One-component system, Eutectic, Congruent, Incongruent, Raoult's, law, Gibbs-Duhem-Margules, Critical solution temperature.

11.2.10. Course Code: CHEMISTRY (DSE-C4)**Course Title: NOVEL INORGANIC SOLIDS****Total Credits: 04 (Credits: Theory-03, Practical-01)****(Total Lectures: Theory- 45, Practical-30)**

Objectives: Solid-state chemistry also referred as material chemistry currently has emerged with great focus on novel inorganic solids. It has found enormous applications in both industrial and research arenas and has helped to shape modern day recyclable adsorbents and catalysts. Novel inorganic-organic hybrid nanocomposites have received a lot of attention because of their abundance and cost-effective nature they can be utilized as catalysts, as a nano reactor to host reactants for synthesis and for the controlled release of biomolecules. Materials such as metals, composites, nanomaterials make life easier in this era and are great sources of industrial advancement and technological changes. Therefore, its exposure to the undergraduates with science backgrounds can groom them for future research.

Learning Outcomes:

By the end of this course, students will be able to:

- Understand the mechanism of solid-state synthesis.
- Explain about the different characterization techniques and their principles.
- Understand the concept of nanomaterials, their synthesis and properties.
- Explain the mechanism of growth of self-assembled nanostructures.
- Understand the real-world importance of bioinorganic nanomaterials.
- Explain the importance of composites and their applications.
- Understand the importance and real-life application of solid materials

Unit 1: Synthesis of Inorganic solids

Conventional heat and beat method, Co-precipitation method, Sol-gel method, Hydrothermal method, Chemical vapor deposition (CVD), Ion-exchange and Intercalation method.

(Lectures:05)

Unit 2: Characterization techniques of inorganic solids

Powder X-ray Diffraction, UV-visible spectroscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Fourier-Transform Infrared (FTIR) spectroscopy, Brunauer–Emmett–Teller (BET) surface area analyser, Dynamic Light Scattering (DLS).

(Lectures: 10)

Unit 3:

Cationic, anionic and mixed solid electrolytes and their applications. Inorganic pigments – coloured, white and black pigments. One-dimensional metals, molecular magnets, inorganic liquid crystals.

(Lectures: 10)

Unit 4: Nanomaterials

Overview of nanostructures and nanomaterials, classification, preparation and optical properties of gold and silver metallic nanoparticles, concept of surface plasmon resonance, carbon nanotubes, inorganic nanowires, Bioinorganic nanomaterials, DNA and its nanomaterials, natural and artificial nanomaterials, self-assembled nanostructures, control of nanoarchitecture, one dimensional control.

(Lectures: 10)

Unit 4: Composite Materials

Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, bio-nanocomposites, environmental effects on composites, applications of composites.

(Lectures: 10)

PRACTICALS (Credits:01; Laboratory Periods: 30)

1. Synthesis of silver nanoparticles by chemical methods / green approach and characterization using UV-visible spectrophotometer.
2. Synthesis of metal sulphide nanoparticles (MnS, CdS, ZnS & CuS) and their characterization using UV-visible spectrophotometer.
3. Intercalation of hydrogen in tungsten trioxide and its conductivity measurement using conductometer.
4. Synthesis of inorganic pigments (PbCrO₄, ZnCrO₄, Prussian Blue, Malachite).
5. Synthesis of pure ZnO and Cu doped ZnO nanoparticles.
6. Preparation of zeolite A and removal of Mg and Ca ions from water samples quantitatively using zeolite.

REFERENCES:

Theory:

- West, A. R. (2014), Solid State Chemistry and Its Application, Wiley.
- Smart, L. E.; Moore, E. A., (2012), Solid State Chemistry: An Introduction CRC Press Taylor & Francis.
- Rao, C. N. R.; Gopalakrishnan, J. (1997), New Direction in Solid State Chemistry, Cambridge University Press.
- Poole Jr.; Charles P.; Owens, Frank J. (2003), Introduction to Nanotechnology, John Wiley and Sons.

Practicals:

- Orbaek, W.; McHale, M.M.; Barron, A. R.; Synthesis and Characterization of Silver Nanoparticles for An Undergraduate Laboratory, J. Chem. Educ. 92, 2015, 339–344.
- Cheng, K.H.; Jacobson, A.J.; Whittingham, M.S. (1981), Hexagonal Tungsten Trioxide and Its Intercalation Chemistry, Solid State Ionics, 5, 1981, 355-358.
- Ghorbani H.R.; Mehr, F.P; Pazoki, H; Rahmani, B.M.; Synthesis of ZnO Nanoparticles by Precipitation Method, Orient J Chem 2015, 31(2).

Teaching Learning Process:

- Conventional chalk and board teaching,
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Assessment Methods:

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- End semester University Theory and Practical Examination

Keywords: Solid State Chemistry, Nanomaterials, Solid electrolyte, Inorganic Pigments, Self-assembled, Composite Materials, Instrumentation.

11.2.11. Course Code: CHEMISTRY (DSE-C5)

Course Title: MAIN GROUP CHEMISTRY

Total Credits: 04 (Credits: Theory-02, Practical-02)

(Total Lectures: Theory- 30, Practical-60)

Objectives: The objective of this paper is to provide basic understanding of the fundamental principles of metallurgy through study of the different methods of extraction and refining of metals. The course illustrates the diversity and fascination of inorganic chemistry through the study of structure, properties and utilities of s- and p-block elements and their compounds