

- Glick B.R., & Patten C.L. (2022). *Molecular Biotechnology: Principles & Applications of Recombinant DNA* (6th Ed.). ASM Press.
- Snustad, D. P., & Simmons. M.J. (2012). *Principles of genetics* (6th ed.). John Wiley & Sons.
- Brown, T.A. (2010). *Gene cloning and DNA analysis: an introduction*. John Wiley & Sons.

Suggestive readings

- Primrose, S. B., & Twyman, R. (2009). *Principles of gene manipulation and genomics*. Wiley.
- Howe, C. J. (2007). *Gene cloning and manipulation*. Cambridge University Press.
- Liebler D. C. (2002) *Introduction to Proteomics: Tools for the New Biology*. Humana Press Inc.
- Scopes R. K. (1994) *Protein Purification: Principles and Practice*, Springer.
- Albala J.S. & Smith I.H. (Eds.). (2003). *Protein Arrays, Biochips and Proteomics: The Next Phase of Genomic Discovery* (1st ed.). CRC Press.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

GENERIC ELECTIVE (GE-01)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Bioinorganic Chemistry ALS CHEM GE 01	4	2	0	2	NIL	NIL

Objectives:

The purpose of the course is to introduce students to bioinorganic chemistry, currently a frontier area of chemistry providing an interface between organic chemistry, inorganic chemistry, and biology. The student would learn about the importance of inorganic chemical species, especially metals in biological systems, through discussions on topics such as the sodium-potassium pump, the applications of iron in physiology, including iron transport and storage system, role of magnesium in energy production and chlorophyll, toxicity of heavy metal ions and their antidotes.

Learning Outcomes:

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

- Classify metal ions in biological systems as essential, non-essential, trace and toxic.
- Diagrammatically explain the working of the sodium-potassium pump in organisms and the factors affecting it.
- Understand the role of metal ions such as Mg, Ca and Fe in biological systems.
- Understand the toxicity of heavy metal ions (Hg, Pb, Cd and As) in the physiological system.

Theory:

Unit 1. Introduction:

Hours: 07

A brief introduction to bio-inorganic chemistry. Metal ions present in biological systems and their classification on the basis of action (essential, non-essential, trace & toxic). Classification of metallobiomolecules (enzymes, transport and storage proteins and non-proteins). Brief idea about membrane transport, channels and pumps.

Unit 2. Role of Metals in Biological Systems: Hours: 08

Role of metal ions present in biological systems with special reference to Na⁺, K⁺ and Mg²⁺ and Ca²⁺ ions: Na/K pump; Ca pump, role of Mg²⁺ ions in energy production and chlorophyll. Role of calcium in bone formation.

Unit 3. Role of Iron in Biological Systems: Hours: 08

Role of iron in oxygen transport and storage (haemoglobin and myoglobin), Perutz mechanism, Cooperative effect, Bohr effect, comparison of oxygen saturation curves of haemoglobin and myoglobin, carbon monoxide. Storage and transport of iron in humans (ferritin and transferrin).

Unit 4. Bio-Inorganic Chemistry:

Hours: 07

Toxicity of heavy metal ions (Hg, Pb, Cd and As), reasons for toxicity and their antidotes.

Practical:

- Preparation of Nickel-DMG complex and its estimation.
- Estimation of Zn^{2+} using EBT / Xylenol orange as indicator
- Estimation of Mg^{2+} by direct complexometric titrations using EDTA.
- Estimation of Ca^{2+} by substitution method.
- To estimate the concentration of Ca in commercially available medicines.
- To estimate the Mg present in multivitamins (take at least two types of Vitamin tablets from the market).
- Isolation of Chlorophyll from plant leaves and its purification.
- Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$.
- Separation of Fe (III) and Al (III) using chromatographic techniques.
- Estimation of copper as $CuSCN$.

Essential/recommended readings

Theory:

1. Huheey, J. E., Keiter, E.A., Keiter, R. L., & Medhi, O.K. (2009). *Inorganic Chemistry-Principles of Structure and Reactivity*. Pearson Education.
2. Shriver, D. D., Atkins, P., & Langford, C.H. (1994). *Inorganic Chemistry* (2nd Ed.). Oxford University Press.
3. Cotton, F. A., Wilkinson, G., & Gaus, P. L. (2021) *Basic Inorganic Chemistry* (3rd Ed.). Wiley India.
4. Crichton, R. R. (2008). *Biological Inorganic Chemistry: An Introduction*. Amsterdam, Elsevier.
5. Kaim, W., Schwederski B., Klein, A. (2014). *Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life: An Introduction and Guide* (2nd Ed.). Wiley.

Suggestive readings

1. Inorganic Chemistry; Sahoo, et al; PHI Learning Private Limited; ISBN 978-81-203-43085.