

Programme: **M. Sc. Part-II (Inorganic Chemistry)**

Course Code: **ICO-501**

Title of the Course: Bioinorganic Chemistry

Number of Credits: **03**

Effective from AY: **2019-20**

Prerequisites for the course:	The students who have done MSc-I Chemistry core courses are eligible to attend	No. of lectures
Course Objectives:	1. To introduce, describe and highlight the role of inorganic elements especially metal ions in biology. 2. To describe the role of small molecular weight model compounds.	
Course Outcomes:	In addition to knowing the essential elements in biology the students will be able to understand the role played by metal ions in vital processes like i) oxygen storage and transport and ii) electron transfer.	
Course Content:	1. Essential elements in biology, distribution of elements in biosphere, bio-availability, bio-stability, building blocks of the biosphere; carbohydrates, nucleic acids and proteins, Biological importance of water, and brief review of the chemistry of biopolymers. Metallobiomolecules: classification of metallobiomolecules, metalloproteins (enzymes), metal activated proteins (enzymes), metal functions in metalloproteins, Principles of coordination chemistry related to bioinorganic research, physical methods in bioinorganic chemistry	6 hr
	2. Introduction, biological importance of the alkali and the alkaline earth cations, Cation transport through membranes (ion pumps). Photosynthesis, Hill reaction, Chlorin macrocycle and chlorophyll, Absorption of light by chlorophyll, role of metals in photosynthesis, in vitro photosynthesis.	6 hr
	3. Non redox metalloenzymes, zinc metalloenzymes like carboxypeptidase, carbonic anhydrase and alcohol dehydrogenase, Bio-functions of zinc enzymes, active site structure and model complexes.	6 hr
	4. Biochemistry of a few transition metals viz. Fe, Mo, Cu and Ni, Oxygen carriers and oxygen transport proteins, iron porphyrins (Haemoglobin and myoglobin). Haemocyanins and Haemerythrins, Synthetic models for oxygen binding haemproteins. cytochrome 'c', catalase peroxidase, and superoxide dismutase, blue copper proteins, vitamin B ₁₂ coenzymes, nitrogen fixation and iron-sulfur proteins, biological nitrogen fixation, nitrogenase and dinitrogen complexes, iron-sulfur proteins, synthetic analogues for Fe-S proteins, core extrusion reactions.	6 hr 6 hr

	5. Metal transport and storage: A brief review of iron transport. 6. Synthesis of simple ligands or isolation of S-containing amino acid or extraction of chlorophyll from green leaves (this will involve both collection of synthetic procedures from library, term paper presentation / discussion)	
Pedagogy	Mainly lectures / tutorials / assignments /group discussion / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	Reference books: 1. S. J. Lippard & J. M. Berg, <i>Principles of Bioinorganic chemistry</i>, Panima Publishing Corporation 2. B. I. Britini, H. B. Gray, S. J. Lippard & J. S. Valentine, <i>Bioinorganic chemistry</i>, University Science books, Mill Valey, CA, 1994. 3. D. E. Fenton, <i>Biocoordination Chemistry</i>, Oxford Chemistry Printers, 25 Oxford University Press, 1995 4. E. E. Conn, P.K. Stumpf, G. Bruening & R. H. Doi, <i>Outlines of Bioinorganic Chemistry</i>, Wiley Eastern, New Delhi, 1983, 5th Ed. 5. F.A. Cotton, G. Wilkinson, P.L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley India, 2007, 3rd Ed. (Chapter 31) 6. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i>, Oxford University Press, 2018, Int. Ed. (Chapter 25) 7. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. (Chapter 27) 8. J. E. Huheey, E.A. Keiter, R.L. Keiter, <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, Addison Wesley Publishing, 5th Ed. (Chapter 19) 9. R. W. Hay, <i>Bioinorganic chemistry</i>, Ellis Horwood Chichester, 1984 10. M.N. Hughes, <i>The Inorganic Chemistry of Biological processes</i>, Wiley (Interscience) New York, 1984, 2nd Ed.	