

Semester	AUG 2022
Open to semester	7,13,21
Course code	CH4124/CH6174
Course title	Bioinorganic Chemistry
Credits	4 /4
Course Coordinator & participating faculty (if any)	V. G. Anand
Nature of Course	Lectures
Pre-requisites	Basic Inorganic Chemistry and Transition Metal Chemistry (preferable)
Objectives (goals, type of students for whom useful, outcome etc)	<p>This course will help students to know and understand the role of metal ions in physiological (aqueous) medium.</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. To understand the role coordination chemistry in metallo proteins 2. Reaction mechanisms involving metal ions in catalysis 3. Thermodynamics and kinetic aspects coordination chemistry 4. Spectroscopy characterization essential to characterize metallo proteins 5. Redox chemistry of transition metal ions in electron transfer process <p>This course can be useful for students interested to understand and explore the chemistry of metal ions known so far in biological systems.</p> <p>At the end of course students should be able to answer the specific role of metal ions in biological systems and also to understand the role of thermodynamics and kinetics in electron transfer process.</p>
Course contents (details of topics /sections with no. of lectures for each)	<ol style="list-style-type: none"> 1) Introduction: 2 Hrs <ol style="list-style-type: none"> a) Brief introduction to Bioinorganic chemistry b) Fundamentals of coordination chemistry. Emphasis on structure and reactivity of coordination complexes 2) EPR spectroscopy: 3-4 Hrs <ol style="list-style-type: none"> a) Introduction to EPR spectroscopy, EPR signals, g-value b) EPR of metal ions in solution and solid state 3) Oxygen metabolism: 6 Hrs

	<ul style="list-style-type: none"> a) Reactivity of O₂ and its reduced forms b) Dioxygen transport hemoglobin/myoglobin; hemerythrin/hemocyanin c) Oxygen-activating enzymes (Cytochrome P-450, methane monooxygenase, dioxygenase) d) Enzymes that utilize peroxide (Catalase & peroxidase) e) Enzymes that remove superoxide (Superoxide dismutase, superoxide reductase, Cytochrome c oxidase) 4) Special Cofactors and metal clusters: 6 Hrs <ul style="list-style-type: none"> a) Electron transport; Inner sphere and outer sphere reactions, Franck-Condon Principle b) Photosynthesis 5) Electron transfer proteins: 8 Hrs <ul style="list-style-type: none"> a) Plastocyanine, Azurin, blue-copper proteins b) Ferredoxin, Cytochrome c and Iron sulfur proteins 6) Transport and storage of Metal ions: 6 Hrs <ul style="list-style-type: none"> a) Transport and storage of iron within organisms (Transferrin, Lactoferrin, ferritin) b) Obtaining iron from the environment (Siderophores, enterobactin, ferrioxamine) 7) Cobalamins: 3 Hrs <ul style="list-style-type: none"> a) Diol dehydrogenase, methylmalonyl-CoA Mutase b) Methionine Synthase, Adenosylcobalamin- dependent ribonucleotide reductase 8) A) Binding of Metal Ions to Proteins: 6 Hrs <ul style="list-style-type: none"> a) Calcium binding proteins b) Calcium Transport B) Binding of Metal Ions to Proteins: <ul style="list-style-type: none"> a) Metal dependent lyases and hydrolases: Carbonic anhydrase and carboxypeptidase A b) Alkaline phosphatase Liver alcohol dehydrogenase c) Zinc Binding domains: Zinc finger 9) Metals in Medicine: 2 Hrs <ul style="list-style-type: none"> a) Metal Based drugs: Cis-platin, carboplatin, platinum anti-cancer drugs b) Radiopharmaceuticals, Gadolinium MRI contrast agents, auranofin c) Metal toxicity: iron overload, mercuric ion reductase, lead
Evaluation /assessment	End-Sem Examination-40% Mid-Sem Examination-40%

	Others-20%
Suggested readings (with full list of authors, publisher, year, edn etc.)	<p>T1. Bioinorganic Chemistry: I. Bertini, H. B. Gray, S. Lippard and J. S. Valentine. (University Science Books, 2007)</p> <p>T2. Biological Inorganic Chemistry (A New Introduction to Molecular Structure and Function): R. R. Crichton. (Elsevier, 2nd edition, 2008)</p> <p>T3. Principles of Bioinorganic Chemistry: Lippard and Berg. (University Science Books, 1994)</p> <p>Optional Textbooks:</p> <p>T4. Physical Methods in Bioinorganic Chemistry: Lawrence Que (University Science Books, 2000)</p> <p>T5. The Natural Selection of The Chemical Elements: J. J. R. Frausto da Silva and R. J. P. Williams. (Oxford, 2nd edition, 2001)</p> <p>T6. The Biological Chemistry of The Elements: J. J. R. Frausto da Silva and R. J. P. Williams. (Oxford, 1996)</p> <p>T7. Biological Inorganic Chemistry (Structure and Reactivity): I. Bertini, H. B. Gray, E. I. Stiefel and J. S. Valentine. (University Science Books, 1st South Asian Edition, 2008, reprint 2007)</p>