

**ELECTIVE-PAPER-A: BIOINORGANIC CHEMISTRY AND SEPERATION
TECHNIQUES**

Semester	Subject Code	Category	Instruction Hours						Credits
			Lecture		Theory		Practical		
			Per Week	Per Semester	Per Week	Per Semester	Per Week	Per Semester	
I	21CPCH1D	Elective	3	45	3	45	0	0	3

COURSE OBJECTIVES:

- ❖ To have a knowledge about protein metallo biomolecules, role of metal ions in biological process, storage and transport of metal ions in biological system, chemical toxicology and uses of inorganic compounds as therapeutic agents.
- ❖ To learn about polymeric bio-organic molecules such as carbohydrates, proteins, nucleic acids, antibiotics, vitamins and to understand about various types of separation techniques for organic and biomolecules.

COURSE OUTCOMES:

- On the successful completion of course, students will be able to

CO Number	CO statement	Knowledge level
CO1	To identify the occurrence, active site structure and functions of some transition metal ion containing metalloproteins or enzymes	K2 & K3
CO2	Gain better knowledge about the structure of metallo enzymnes, importance of transport and storage metals in biological systems.	K2 & K3
CO3	Acquire the skill of relating all the biomolecules in various biological systems and can gain knowledge about the biological importance of proteins, nucleic acids and carbohydrate	K3 & K4
CO4	Gain clear knowledge about the chemistry and physiological action of antibiotics, vitamins and carotenoids	K3 & K4
CO5	To apply principles of separation and isolation techniques in organic reactions leading to the separation and purification of various products	K2 & K3

* CO-Course Outcomes

Knowledge level K1-Remember; K2-Understand; K3-Apply; K4-Analyze

MAPPING WITH PROGRAM OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	M	M	S	S
CO2	M	M	S	S	S	M
CO3	M	S	S	S	M	M
CO4	M	S	S	M	M	M
CO5	S	S	S	S	S	S

UNIT-I: METALLO PROTEINS

9 hours

Iron containing proteins: Metalloporphyrins – Haemoglobin and myoglobin – Structures and work functions – synthetic oxygen carriers – Cytochrome – structure and work function. Non – heme oxygen carriers – Electron carrier proteins – Iron sulphur proteins – Ferridoxin and Rubredoxin – Magnesium containing proteins: Chlorophyll – structure – photosynthetic sequence – Copper containing proteins: Classification – blue copper proteins – structure of blue copper electron transferases – copper protein as oxidases – cytochrome c oxidase – mechanistic studies of cytochrome c oxidase

UNIT II: METALLO ENZYMES

9 hours

Metalloenzymes: Carboxy peptidase A – structure and function; Carbonic anhydrase – inhibition and poisoning – Corrin ring system – Vitamin B₁₂ (cyanocobalamin) and B₁₂ coenzymes – *In vivo* and *In vitro* nitrogen fixation – nitrogen cycle.

Essentials of trace elements and chemical toxicology: Trace elements in biological system – sodium, potassium, calcium, zinc and copper – Metal ion toxicity - classes of toxic metal compounds – detoxification.

Metals in medicine: Antiarthritis drugs – Au and Cu in rheumatoid arthritis – Li in psychiatry – Pt, Au and metallocenes in anticancer drugs- metals in radiodiagnosis and magnetic resonance imaging.

Transport and storage of metals: Mechanism – Fe, Cu, Zn and V storage and transport – metallothioneins – Molecular mechanism of iron transport across the membrane – sodium and potassium ion pumps.

UNIT-III: BIOMOLECULES

9 hours

Amino acids and Proteins: Amino acids and Protein structure, peptides and their synthesis – (tripeptide using the amino acids glycine, alanine, lysine, cysteine, glutamic acid and arginine) – Analysis of N– terminal and C – terminals in a polypeptide. Sanger method, Edman degradation and Enzymatic analysis. Merrifield synthesis – Primary, secondary and tertiary structure of proteins.

Nucleic acids and Carbohydrates: Chemistry of nucleic acids, nucleosides and nucleotides – Structure RNA and DNA and their biological importance – Pyranose and furanose

forms of aldohexose and ketohexose – methods used for the determination of ring size – conformation of aldohexopyranose – structure and synthesis of lactose and sucrose. A brief study of starch and cellulose.

UNIT-IV: ANTIBIOTICS, VITAMINS AND CAROTENOIDS

9 hours

Biomolecules: Antibiotics and vitamins: A detailed study of structure, stereochemistry and synthesis of penicillin, cephalosporin – Chemistry and physiological action of ascorbic acid, thiamin, riboflavin and pyridoxine – Elementary aspect of vitamin A, E, K and B₁₂ - Synthesis of vitamin A₁ using Reformarsky method, Wittig reaction method, jansen method, Attenburrow method, Isler method – Synthesis of Vit- A₂ -Carotenoids – introduction – synthesis of α -carotene, β -carotene, γ -carotene and lycopene.

UNIT V: SEPARATION TECHNIQUES

9 hours

Basic aspects of thin-layer chromatography (TLC), column chromatography and flash vacuum column chromatography – Principles, theory, instrumentation and applications of Ion – exchange column Chromatography, Gel-permeation Chromatography, Gas chromatography and High Performance Liquid chromatography (HPLC) – Interpretation of chromatogram and separation of components from the mixture.

Distribution of hours: Theory-100%; Problems-Nil

TEXT BOOKS

S.No	Authors	Title	Publishers	Year of publication
1.	S. J. Lippard and J. M. Berg	Principles of Bioinorganic Chemistry	BergPanima Publishing Corporation	1997
2.	W. Kaim and B. Schwederski	Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, (An Introduction and Guide),	John Wiley and Sons	1994
3.	J. E. Huheey, E. A. Keiter and R. L. Keiter.	Inorganic Chemistry, Principles of Structure and Reactivity	Pearson Education	2004

4.	F. A. Cotton and G. Wilkinson,	Advanced Inorganic Chemistry	Wiley Eastern	1998
5.	<u>Geoffrey L. Zubay</u> , <u>William W. Parson</u> and <u>Dennis E. Vance</u>	Principles of Biochemistry	McGraw-Hill Education	1995
6.	<u>David L. Nelson</u> and <u>Michael M. Cox</u>	Principles of Biochemistry	WH Freeman	2017
7.	John McMurray	Organic Chemistry	International Edition 8 th Ed	2017
8.	I.L.Finar,	Organic Chemistry Vol 2, Stereochemistry and the Chemistry of Natural Product	Dorling Kindersley India (P) Ltd	2009
9.	B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell,	Vogel's text book of Practical Organic Chemistry	Pearsons Education (Singapore) PTE Ltd, 3 rd Indian Reprint	2005
10.	Douglas A. Skoog, F. James Holler and Stanley R. Crouch	Principles of Instrumental Analysis	CENAGE Learning, 7 th Ed	2018
11	D. A. Skoog and D. M. West	Fundamentals of Analytical Chemistry	Holt Rinehart and Winston Publications, 4 th Ed	1982
12	Douglas A. Skoog, Donald M. West, F. James and Stanley R. Crouch,	Fundamentals of Analytical Chemistry	8 th Ed	2004
13	Lloyd R. Snyder, Joseph J. Kirkland and John W. Dolan,	Introduction to Modern Liquid Chromatography	Wiley 3 rd Ed	2009

REFERENCE BOOKS

S.No	Authors	Title	Publishers	Year of publication
1.	Gurdeep Charwal,	Chemistry of natural products	Himalaya publishing house	2018
2.	O.P. Agarwal,	Chemistry of natural products	GOEL Publishing house	2015
3.	I.L. Finar,	Organic chemistry, Stereochemistry and chemistry of natural products	Volume II, Pearson Education	2002

TEACHING METHODOLOGY:

- PowerPoint presentation
- Group discussion
- Seminar and Assignments
- Animated videos
- Board and chalk

SYLLABUS DESIGNERS:

1. Dr. T. Gomathi, Assistant Professor, Department of Chemistry
2. Mrs. J. Saranya, Assistant Professor, Department of Chemistry
3. Dr. D. Shakila, Assistant Professor, Department of Chemistry