

Course Title – <b>DSE: Organometallics, bioinorganic chemistry, polynuclear hydrocarbons and UV, IR spectroscopy <i>w.e.f. the session 2024-25 and onwards</i></b>	
Class: B.Sc. Pt.-III / Semester-V	Course code: BCH-E501
Lecture: 60	Credits: 04
MM: 70	Exam Hrs: 03

**NOTE:** The question paper shall consist of Two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer (about 150 words) type questions of SIX marks each and student shall be required to attempt any five questions. Sec.-B shall contain 08 descriptive type questions of TEN marks each and student shall be required to attempt any four questions. Both sections shall have questions from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

**Course Contents:**

**Section A: Inorganic Chemistry-4 (30 Lectures)**

**Chemistry of 3d metals**

Oxidation states displayed by Cr, Fe, Co, Ni and Co.

A study of the following compounds (including preparation and important properties);

Peroxo compounds of Cr,  $K_2Cr_2O_7$ ,  $KMnO_4$ ,  $K_4[Fe(CN)_6]$ , sodium nitroprusside.

**(6 Lectures)**

**Organometallic Compounds**

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

**(12 Lectures)**

**Bio-Inorganic Chemistry**

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to  $Na^+$ ,  $K^+$  and  $Mg^{2+}$  ions: Na/K pump; Role of  $Mg^{2+}$  ions in energy production and chlorophyll. Role of  $Ca^{2+}$  in blood clotting, stabilization of protein structures and structural role (bones).

**(12 Lectures)**

**Section B: Organic Chemistry-4 (30 Lectures)**

**Polynuclear and heteronuclear aromatic compounds:**

Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.

**(6 Lectures)**

**Active methylene compounds:**

*Preparation:* Claisen ester condensation. Keto-enol tautomerism.

*Reactions:* Synthetic uses of ethylacetoacetate

**(6 Lectures)**

**Application of Spectroscopy to Simple Organic Molecules**

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic

radiations, electronic transitions,  $\lambda_{\max}$ , chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating  $\lambda_{\max}$  of conjugated dienes.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes, simple alcohols, aldehydes, ketones and carboxylic acids.

(18 Lectures)

### Reference Books:

1. James E. Huheey, Ellen Keiter & Richard Keiter: *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Publication.
2. G.L. Miessler & Donald A. Tarr: *Inorganic Chemistry*, Pearson Publication.
3. J.D. Lee: *A New Concise Inorganic Chemistry*, E.L.B.S.
4. F.A. Cotton & G. Wilkinson: *Basic Inorganic Chemistry*, John Wiley & Sons.
5. I.L. Finar: *Organic Chemistry* (Vol. I & II), E.L.B.S.
6. John R. Dyer: *Applications of Absorption Spectroscopy of Organic Compounds*,  
a. Prentice Hall.
7. R.M. Silverstein, G.C. Bassler & T.C. Morrill: *Spectroscopic Identification of  
a. Organic Compounds*, John Wiley & Sons.
8. R.T. Morrison & R.N. Boyd: *Organic Chemistry*, Prentice Hall.
9. Peter Sykes: *A Guide Book to Mechanism in Organic Chemistry*, Orient  
a. Longman.

Arun Bahl and B. S. Bahl: *Advanced Organic Chemistry*, S. Chand.

### Course Objectives

1. To have a sound knowledge of transition metal complexes, carbonyls and organometallics, understand the role of metals in biological systems.
2. To learn about polynuclear and active methylene compounds.
3. To be able to apply and interpret the various spectroscopic techniques viz. UV-Vis and IR spectroscopy for identification of organic molecules.

### Course Outcomes (Cos)

After the completion of this course, a student should be able to:

CO:1 Understand the properties of transition metals and some of their useful/ important compounds.

CO:2 Synthesis of transition metal complexes and measure their conductivity for their characterization.

CO:3 Have a sound knowledge of important organometallic compounds like carbonyls.

CO:4 Understand the roles of metals in biological systems especially in photosynthesis, enzyme catalysis, blood clotting etc.

CO:5 Understand the pros and cons of polynuclear and heterocyclic compounds.

CO:6 Apply and interpret the various spectroscopic techniques viz. UV-Vis and IR spectroscopy for identification of organic molecules.

Course Outcomes (Cos) / Program Outcomes (Pos)	1	2	3	4	5	6	7	8
CO:1	×	×						
CO:2		×	×					×
CO:3		×						×
CO:4	×	×		×				
CO:5		×						×
CO:6		×	×					×

Note: put 'X' in relevant column of mapping