

Teaching Plan 2024

B.Sc. Physical Science CBCS, VI Sem

Subject: Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR

Spectroscopy

Teacher: **Dr. Aditi Puri**

Course Code: CHEMISTRY –DSE-12

Course Title: Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy

Total Credits: 06

(Credits: Theory-04, Practical-02)

(Total Lectures: Theory- 60, Practical-60)

Objectives:

The purpose of the course is to introduce students to some important 3d metals and their compounds which they are likely to come across. Students learn about organometallic compounds and bioinorganic chemistry which are currently frontier areas of chemistry providing an interface between organic chemistry, inorganic Chemistry and biology. The functional group approach to organic chemistry

introduced in the previous courses is reinforced through the study of the chemistry of carboxylic acids and their derivatives, Amines and diazonium salts, active methylene compounds. The students will also be introduced to the chemistry and applications of polynuclear hydrocarbons and heterocyclic compounds. The learners are introduced to spectroscopy, an important analytical tool which allows identification of organic compounds by correlating their spectra to structure.

Learning Outcomes:

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

- Understand the chemistry and applications of 3d elements including their oxidation states and important properties of the familiar compounds potassium dichromate, potassium permanganate and potassium ferrocyanide
- Use IR data to explain the extent of back bonding in carbonyl complexes
- Get a general idea of toxicity of metal ions through the study of Hg^{2+} and Cd^{2+} in the physiological system
- Understand the fundamentals of functional group chemistry, polynuclear hydrocarbons and heterocyclic compounds through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
- Gain insight into the basic fundamental principles of IR and UV-Vis spectroscopic techniques.
- Use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules.

Section A: Inorganic Chemistry (Lectures:30)

Unit 1:

Chemistry of 3d metals

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Chemistry of 3d metals

General discussion of 3d metals. Oxidation states displayed by Cr, Fe, Co, Ni and Cu.

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

$K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$.

(Lectures: 6)

Unit 2:

Organometallic Compounds

Definition and classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structure and bonding of methyl lithium and Zeise's salt. Structure and physical properties of ferrocene. 18-electron rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. π -acceptor behaviour of carbon monoxide (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

(Lectures: 12)

Unit 3:

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. Brief introduction to oxygen transport and storage (haemoglobin-myoglobin system). Brief introduction about toxicity of metal ions (Hg^{2+} and Cd^{2+}).

(Lectures: 12)

Week	Dates From – To	Topic
1.	22/01/2024 - 27/01/2024	General discussion of 3d metals. Oxidation states displayed by Cr, Fe, Co, Ni and Cu
2.	29/01/2024- 03/02/2024	A study of the compounds (including preparation and important properties): $K_2Cr_2O_7$, $KMnO_4$.
3.	05/02/2024- 10/02/2024	$K_4[Fe(CN)_6]$ Definition and classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds).
4.	12/02/2024- 17/02/2024	Structure and bonding of methyl lithium and Zeise's salt.
5.	19/02/2024 - 24/02/2024	Structure and physical properties of ferrocene.
6.	26/02/2024- 02/03/2024	18-electron rule as applied to carbonyls.
7.	04/03/2024- 09/03/2024	Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals.

8.	11/03/2024- 16/03/2024	π -acceptor behaviour of carbon monoxide (MO diagram of CO to be discussed)
9.	18/03/2024 - 23/03/2024	Synergic effect and use of IR data to explain extent of back bonding.
10.	01/04/2024 - 06/04/2024	Test of Unit 1, A brief introduction to bio-inorganic chemistry.
11.	08/04/2024- 13/04/2024	Role of metal ions present in biological systems with special reference to Na^+ , K^+ and Mg^{2+} ions:
12.	15/04/2024- 20/04/2024	Na/K pump, Role of Mg^{2+} ions in energy production and chlorophyll
13.	22/04/2024- 27/04/2024	Brief introduction to oxygen transport and storage (haemoglobin-myoglobin system)
14.	29/04/2024 - 04/05/2024	Brief introduction about toxicity of metal ions (Hg^{2+} and Cd^{2+})
15.	06/05/2024- 11/05/2024	Tests / Assignments