

## DISCIPLINE SPECIFIC ELECTIVE COURSE CHEM-DSE -10: Applied Inorganic Chemistry

### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
<b>Chem-DSE 10: Applied Inorganic Chemistry</b>	<b>04</b>	<b>02</b>	<b>-</b>	<b>02</b>	<b>Class XII with Science</b>	

### Learning Objectives

The Learning Objectives of this course are as follows:

- To introduce the principles of catalysis. It further discusses the types of catalysts and their industrial applications. It gives an insight into different types of fertilizers and chemistry involved in their manufacturing.
- To learn about applications of metals and inorganic compounds as diagnostic agents and medicines. The course helps develop the interest of students in the frontier areas of applied inorganic and medicinal chemistry.

### Learning outcomes

By studying this course, students will be able to:

- Get a general idea of catalysis and describe in detail the mechanism of Wilkinson's catalyst, Zeigler-Natta catalyst and synthetic gasoline manufacture by Fischer-Tropsch process and applications of zeolites and biocatalysis.
- Explain the suitability of fertilizers for different kinds of crops and soil.
- Explain the inorganic compounds and metals in medicine and, specifically, the role of cisplatin in cancer therapy

### Syllabus

#### Unit 1: Catalysis

(Hours: 10)

General principles of catalysis, properties of catalysts, homogeneous and heterogeneous catalysis (catalytic steps, examples) and their industrial applications, deactivation and regeneration of catalysts, catalytic poison, promoter. Study of the following processes and their mechanism:

1. Alkene hydrogenation (Wilkinson's Catalyst)
2. Synthetic gasoline (Fischer-Tropsch reaction)

3. Polymerisation of ethene and propene using Ziegler-Natta catalyst
4. Application of zeolites as catalysts.  
Introduction and importance of biocatalysis

## **Unit 2: Fertilizers**

**(Hours: 8)**

Different types of fertilizers (N, P and K). Importance of fertilizers, chemistry involved in the manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime and potassium chloride, Environmental aspects of fertilizers.

## **Unit 3: Medical Applications of Inorganic Compounds**

**(Hours: 12)**

Introduction, Use of Chelating agents, metal complexes as diagnostic agents, Lithium in mental health, Gold containing drugs, role of metals in Neurodegenerative Diseases, Inorganic compounds in Chemotherapy: Cisplatin; mode of action, basic idea of second and third generation drugs.

## **Practical Component (Laboratory Periods: 60)**

**Credits:02**

1. Preparation of magnesium pyrosilicate (Antacid).
2. Determination of ascorbic acid in vitamin C tablets by iodometric titrations.
3. Preparation of borax.
4. Preparation of boric acid.
5. Catalytic oxidation of potassium sodium tartrate by cobalt(II) chloride.
6. Estimation of boric acid and borax in a mixture by titrimetric analysis
7. Detection of constituents of CAN fertilizer (Calcium, Ammonium and Nitrate ions) fertilizer and estimation of Calcium content.
8. Detection of constituents of Superphosphate fertilizer (Calcium and Phosphate ions) and estimation of phosphoric acid content.
9. Detection of constituents of Dolomite (Calcium, Magnesium and carbonate ions) and determination of composition of Dolomite (Complexometric titration)

## **References:**

### **Theory:**

1. Huheey, J.E.; Keiter, E.A.; Keiter; R. L.; Medhi, O.K. (2009), **Inorganic Chemistry- Principles of Structure and Reactivity**, Pearson Education.
2. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010), Shriver and Atkins **Inorganic Chemistry**, 5th Edition, Oxford University Press.
3. Housecraft, E. H.; Sharpe, A.G. (2018), **Inorganic Chemistry**, 5<sup>th</sup> Edition, Pearson.
4. Greenwood, N.N.; Earnshaw, A. (1997), **Chemistry of the Elements**, 2nd Edition, Elsevier (Ziegler Natta Catalyst and Equilibria in Grignard Solution).
5. Lippard, S.J.; Berg, J.M. (1994), **Principles of Bioinorganic Chemistry**, Panima Publishing Company.
6. Spessard, Gary O.; Miessler, Gary L. (1996), **Organometallic Chemistry**, Prentice-Hall.

7. Fertilizers and Their Composition, Characteristics, Quality, Transformations and Applications, Tandon, H.L.S., 2008., **Riegel's Handbook of Industrial Chemistry**, CBS Publishers, New Delhi.
8. Patrick, G. (2017), **Introduction to Medicinal Chemistry**, Oxford University Press.
9. Wolfgang Kaim, Brigitte Schwederski, Axel Klein, **Bioinorganic chemistry: Inorganic elements in the chemistry of life**, John Wiley & Sons Inc.

**Practicals:**

1. Vogel, A.I. (1972), **Qualitative Inorganic Analysis**, Longman.
2. Svehla, G. (1996), **Vogel's Qualitative Inorganic Analysis**, Prentice Hall.
3. Marsh, D.G.; Jacobs, D.L.; Veening, H., J. Chem. Educ., Analysis of commercial vitamin C tablets by iodometric and coulometric titrimetry. 1973, 50 (9), p 626. DOI: 10.1021/ed050p626
4. <https://edu.rsc.org/experiments/catalytic-oxidation-of-potassium-sodiumtartrate/1736.article>

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.