

SEMESTER IV

KU4DSCCHE201: INORGANIC CHEMISTRY -II

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC	200	KU4DSCCHE201	4	75

Learning Approach (Hours/Week)		Marks Distribution			Duration of ESE (Hours)
Lecture/ Tutorial	Practical/ Internship	CE	ESE	Total	
3	2	35	65	100	1.5

Course Description: This paper describes the concepts of metals in biological systems, transition elements, inner transition elements, industrially important compounds, metallurgy and organometallic compounds. Practical session deals with the qualitative analysis of cations and preparation of inorganic complexes.

Course Prerequisite: Basic knowledge in transition metals and industrially relevant molecules.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Comprehensive understanding about transition and inner transition elements	U
2	Able to explain the industrial importance of certain inorganic compounds and metallurgical process for extracting metals from ores.	U

3	Differentiate the role of different metals in various biological processes	An
4	Comprehensive understanding about organometallic compounds, their structure and applications	U
5	Acquire skill in the qualitative analysis of salt mixtures	A

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1							
CO 2							
CO 3							
CO 4							
CO 5							

Course Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	TRANSITION AND INNER TRANSITION ELEMENTS		10
	1.	General properties of transition elements – Electronic configurations, Oxidation states, colour, magnetic properties, tendency to form complexes and catalytic properties. Comparison of first transition series with second and third series.	

2.	Lanthanides – Occurrence, separation by ion-exchange chromatography. Electronic configurations, oxidation states, magnetic properties and spectra of lanthanides. Lanthanide Contraction—causes and consequences.	
3.	Actinides: Electronic configurations, oxidation states, spectra and magnetic properties. Trans actinide elements – Preparation, IUPAC nomenclature. Comparison of transition and inner transition elements	

2.	INDUSTRIALLY IMPORTANT INORGANIC COMPOUNDS AND METALLURGY	12
1.	Structure, properties and uses of: Hydrides of boron – B_2H_6 and B_4H_{10} (preparation also). Borazine, Boric acid, Inter halogen compounds, Pseudo halogens, Fluorocarbons. Inorganic polymers- Phosphorous based, sulphur based, and silicon based - silicones and silicates - polymers.	
2.	Occurrence of metals. Various steps involved in metallurgical processes. Electrometallurgy, Hydrometallurgy. Coinage metals - Occurrence and extraction of copper, silver and gold. Powder metallurgy (brief discussion). Alloy steels- composition of alloy steels - application of alloy steels. Heat treatment of steel. Nonferrous alloys and their uses – Refractories – definition, classification and uses.	

3.	METALS IN BIOLOGICAL SYSTEMS	8
1.	Myoglobin and Haemoglobin - Structure and functions of haemoglobin and myoglobin. Cooperativity effect. Bohr effect.	
2.	Metallo enzymes of iron and zinc (structural details not needed).	
3.	Metal ion transport across cell membrane – sodium/potassium pump.	
4.	Biological functions of Co, Mn, Zn, Mg and Ca and toxicity of - As, Cd, Pb, Hg.	
5.	Biological fixation of nitrogen.	

ORGANOMETALLIC COMPOUNDS		15
4.	1.	Introduction - Classification based on the nature of metal-carbon bond. Preparation, structure - valence bond theory - of mononuclear (Ni, Fe), binuclear (Fe, Mn, Co) and trinuclear (Fe) metal carbonyls - Application of 18 electron rule to predict M-M bond.
	2.	Preparation, properties, structure and bonding of Ferrocene- Preparation and properties of -carbonyl hydrides, carbonylated anions and cations and carbonyl halides – Preparation and properties of nitric oxide complexes- Preparation of dinitrogen complexes.

5	TEACHER SPECIFIC MODULE-PRACTICALS		30
	<i>Minimum 6 mixtures to be analysed and recorded. One more experiment other than mixture analysis to be carried out and recorded as per teacher's choice.</i>		
	INORGANIC QUALITATIVE ANALYSIS-II		
	1.	Systematic qualitative analysis of mixture two anions and cations by semi micro method. The cation mixtures may be given as solution. Cations in same group can be avoided. Cations given for analysis may include NH_4^+ , Al^{3+} , Co^{3+} , Ni^{2+} , Zn^{2+} , Mn^{2+} , Ba^{2+} , Ca^{2+} , Mg^{2+} etc.	
	2	Open ended (Suggestions) a) Bordeaux mixture preparation, application and warnings b) Virtual laboratory- Forensic toxicology- Heavy metal ions	

Essential Readings:

1. J E Huheey, E A Keiter, R L Keiter, O K Medhi, Inorganic Chemistry, Pearson.
2. B R Puri, L R Sharma, K C Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi.
3. F A Cotton and G Wilkinson, Advanced Inorganic Chemistry 5th edn., John Wiley, New York.

4. R C Mehrothra and A Singh, Organometallic chemistry, New age publishers.
5. D F Shriver and P W Atkins, Inorganic Chemistry 3rd edn., Oxford University Press.
6. J D Lee, Concise Inorganic Chemistry 5th edn., Blackwell Science, London.
7. R A Mackay, W Henderson, Introduction to Modern Inorganic Chemistry, 6th edition
Nelson Thornes Ltd.
8. Emelus and Anderson, Principles of Inorganic Chemistry.
10. Vogel's Textbook of Qualitative Analysis

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation (ESE)		65 (50T+15P)
Continuous Evaluation (CCA)		35 (25T+10P)
Theory		25
a)	Test Paper*	10
b)	Assignment	5
c)	Viva-Voce	5
d)	Seminar	5
Practical		10
a)	Skill	4
b)	Record	4
c)	Punctuality	2
Total		100

*Average mark of the best two written tests may be considered for internal mark.