

SEMESTER – II**KU2DSCCHE101: FUNDAMENTALS OF CHEMISTRY- II**

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100	KU2DSCCHE101	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: The course covers modules on chemical bonding, acids and bases, fundamentals of coordination chemistry, introduction to solid state, organic reaction mechanism and quantitative analysis involving redox titrations and complexometry.

Course Pre-requisite: Elementary knowledge in PUC level Chemistry

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the principles of chemical bonding, coordination compounds and acid base concepts.	U
2	Apply the concept of hybridisation and VSEPR theory in predicting the shape of molecules	A
3	Develop basic knowledge about reaction intermediates and aromaticity of molecules	K

4	Analyse the electron displacement and structural effects on the reactions of organic compounds and explain the properties	A
5	Understand the types of packing and imperfections in solids and their role in determining the properties of solids and solve problems for calculating number of atoms per unit cell and packing efficiency.	A
6	Develop advanced practical skills in volumetric analysis, interpreting and communicating results effectively in a laboratory setting.	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	3	3	0	0	0	0	0
CO 2	3	3	0	0	0	0	1
CO 3	0	0	2	0	0	0	0
CO 4	0	0	0	3	0	1	1
CO 5	0	0	0	0	3	0	1
CO6	0	0	0	0	0	3	2

Course Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOUR S
1	CHEMICAL BONDING		12
	1	General characteristics, types of ions-Factors affecting the formation of ionic compound Lattice energy – Born- Lande equation with derivation - Madelung constant Born Haber cycle and its application -Covalent bond - Valance bond theory and its limitations	
	2	Hybridization and shapes of simple molecules (BeF ₂ , PCl ₃ , SF ₆ , CH ₄ , CH ₃ - CH ₃ , CH ₂ =CH ₂ , CH≡CH)	
	4	VSEPR theory – Shape of molecules and ions (NH ₃ , XeF ₆ , ClF ₃ , NH ₄ ⁺ , H ₃ O ⁺)	
		Molecular orbital theory- homodiatomic molecules and heterodiatomic molecules (HCl and NO)- LCAO method- Bond strength and bond energy - Polarisation and Fajan's rule	

2	ACIDS AND BASES & FUNDAMENTALS OF COORDINATION CHEMISTRY			14
	1	Concepts of Lowry and Bronsted – Lux – Arrhenius concept, flood concept – The solvent system concept – The Lewis concept		
	2	Relative strength of Acids and Bases – Effect of solvent – Levelling effect –Effect of polarity and substituents		

	3	Hard and soft acids and bases – Pearson’s concept –Bonding in hard–hard and soft–soft combinations – HSAB principle and its applications –Basis for hard- hard and soft–soft interactions.	
	4	Classification of solvents – characteristic properties of a solvent – study of liquid ammonia	
	5	Introduction-Double salts and Coordination compounds-Werners coordination theory- Classification of coordination compounds-.	
	6	Types of ligands. Chelates-Nomenclature of coordination compounds-	
	7	Stereochemistry of coordination compounds with coordination number 2 to 6-Isomerism -Application of coordination compounds in qualitative and quantitative analysis	
	INTRODUCTION TO SOLID STATE		6
3	1	General characteristics of solids- amorphous and crystalline solids- classification of crystalline solids- crystal lattices and unit cells	
	2	Number of atoms in unit cell- close packed structures- packing efficiency- calculations involving unit cell dimensions-	
	3	Imperfections in solids- point defects-stoichiometric -impurity and non-stoichiometric (Explain different types of each)	
	ORGANIC REACTION MECHANISM		12
4	1	Electron displacement in organic molecules- inductive effect, Electromeric effect, Resonance or Mesomeric effect and Hyper conjugation	
	2	Steric effect- Tautomerism Applications of electron displacement effect in the order of acidity of Carboxylic acids, Phenol and Basicity of amines-	
	3	Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine. - comparative basic strength of aniline, N-methylaniline and N, N-dimethyl aniline (in aqueous and non- aqueous	

		medium), steric effects and substituent effects- Application of steric effect in the basicity of substituted aromatic amines	
	4	Effect of hyperconjugation in the stability of isomeric alkenes- Explanation of Order of stability of carbonium ions, carbanions, and free radicals.	

	PRACTICAL -VOLUMETRIC ANALYSIS II	30
	<i>Minimum 6 experiments must be done. Of the 6 experiments 2 are open ended.</i>	
5	Redox titrations-Dichrometry 1.Estimation of Fe^{2+}, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$/Mohr's salt using internal indicator 2.Estimation of Fe^{2+}, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$/Mohr's salt using external indicator Iodometry And Iodimetry 1.Estimation of Cu^{2+} / $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. 2. Estimation of potassium dichromate. Complexometry Estimation of Mg^{2+}, Zn^{2+} and hardness of water Open ended (Familiarise the use of PhET in any two volumetric experiments) Suggestions 1.Estimation of Fe^{3+} - reduction by SnCl_2 - internal indicator (Dichrometry) 2.Estimation of $\text{As}_2\text{O}_3/\text{As}^{3+}$(Iodometry) 3.Estimation of chloride in neutral medium (Precipitation titration-using adsorption indicators)	

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 Ka.lia, 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. J. D. Lee, Concise Inorganic Chemistry 5th edn, Blackwell Science, London
5. 1 P. S. Kalsi' 'Organic Reactions and their Mechanisms'' New Age International Publishers
6. Peter Sykes, 'A Guidebook to Mechanism in Organic Chemistry', Pearson Education
7. P. Y. Bruice, 'Organic Chemistry', Pearson Education.
8. Introduction to solids Leonid V Azaroff
9. Solid state chemistry by Lesley E. Smart and Elaine A. Morre
10. Solid state chemistry and its applications-Antony. R. West
11. D A Skoog, D M West, Analytical Chemistry, An Introduction, 4th Edn., CBS Publishing Japan Ltd., 1986
12. G D Christian, Analytical Chemistry, John Wiley, and Sons.
13. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denny, Vogel's Textbook of Quantitative Chemical Analysis, 5th Edn., ELBS, 1989.
14. R. Gopal, Inorganic Chemistry for undergraduates, Universities press, India Pvt.Ltd, 2009.

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.