

SEMESTER - I

KU1DSCCHE101: FUNDAMENTALS OF CHEMISTRY- I

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
1	DSC	100	KU1DSCCHE101	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 comprehensive course offers an enriching exploration of fundamental concepts of atomic structure, periodicity in properties of elements, theories of quantitative analysis, organic chemistry, and organic reaction mechanism. The practical component will enhance skill in preparing solutions, volumetric estimation and familiarise the use of online resources to understand Chemistry in a better way.

Course Prerequisite: Elementary knowledge in PUC level Chemistry

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Demonstrate a good understanding of the various theories on atomic structure and periodicity in the properties of elements.	U
2	Apply the acquired knowledge about periodicity to predict and explain the properties of elements.	A
3	Analyse and apply the rules in representing organic compounds with structural formulae and naming organic compounds	A
4	Develop skill in solving problems involving stoichiometric calculations	E
5	Develop skills in practical Chemistry and in using online resources	A

6	Demonstrate good laboratory practices.	A
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**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	1	2	1	2	2	2
CO 2	3	1	2	1	2	2	2
CO 3	3	1	2	1	2	2	2
CO 4	3	1	2	1	2	2	2
CO 5	3	1	2	1	2	2	2
CO6	3	1	2	1	2	2	2

Course Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOU RS
		ATOMIC STRUCTURE AND PERIODICITY	15
1	1	Atomic structure-Classical mechanics – concept- Bohr theory of atom Calculation of Bohr radius, velocity, and energy of an electron- Atomic spectra of hydrogen- Limitations of Bohr theory- failure of classical mechanics- Black body radiation (concept only, no derivation required)- Planck’s law of radiation- Photoelectric effect	
	2	Heisenberg’s uncertainty principle and its significance- dual nature of electrons- Davisson and Germer’s experiment- de Broglie hypothesis-	

		Quantum numbers- Shapes of orbitals – Aufbau principle-Pauli's exclusion principle and Hund's rule - Electronic configuration of atoms	
	3	Periodic table-Evolution of modern periodic table-Modern periodic law- Periodicity in properties – Atomic, ionic, covalent radii- Ionisation Potential- Electron Affinity -Electronegativity – Pauling's scale--Allred Rochow's scale and Mulliken Scale of electronegativity	
	4	Effective nuclear charge –Screening effect – Slater rules (problems required)	

2	THEORETICAL BASIS OF QUANTITATIVE ANALYSIS& GOOD LABORATORY PRACTICES		10
	1	Fundamental concepts of quantitative analysis– mole, molarity, normality, molality, ppm, ppb, mole fraction–percentage (by mass and volume)	
	2	Primary standard – secondary standard -standard solutions – quantitative dilution from stock solutions by serial dilution method–numerical problems- Theory of acid and base titrations --indicators used in acid base titrations- Theory of redox titrations(Permanganometry and dichrometry),Theory of complexometry	
	3	Safe laboratory practices and Lab safety signs-Personal protective equipment (PPE) in Chemical laboratory- Awareness of Material Safety Data Sheet (MSDS).	
	4	Hazard Symbols and Signs (Physical, Chemical, Environmental and Health)- Lab accidents and safety measures Simple first aids: Electric shocks, fire accidents, burn by chemicals, cut by glass and inhalation of poisonous gases	
3	INTRODUCTION TO ORGANIC CHEMISTRY		10
	1	Classification of Organic compounds-homologous series	

	2	IUPAC system of nomenclature of aliphatic, alicyclic and aromatic compounds: hydrocarbons (alkane, alkene and alkynes), halo compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids, acid halides, anhydrides, esters, amides, amines, nitriles, nitro-compounds and cycloalkanes.	
	3	Familiarise structural formula of atleast 3 lower members of each homologous series	

	INTRODUCTION TO ORGANIC REACTION MECHANISM		10
4	1	Bonding notations- drawing electron movements with arrows-curved arrow notations-half headed and double headed arrows- electronegativity - polarity in bonds- homolytic and heterolytic bond fission	
	2	Reaction intermediates- carbocations, carbanions- generation and structure only	
	3	Reaction intermediates-free radicals, carbenes, and nitrenes – generation and structure only	
	4	Types of reactions: addition, substitution, elimination and rearrangement with simple examples-Electrophiles and nucleophiles with examples	

	TEACHER SPECIFIC MODULE-PRACTICAL CHEMISTRY -I	30
	<i>Minimum one experiment for the preparation of solutions of each type, two experiments in acidimetry -alkalimetry, and two in permanganometry must be done. Familiarise soft skill development virtual lab experiments and simple organic compounds as per teacher's choice.</i>	
	1)Preparation of solutions a) Standard solutions (normal, molar) b) percentage by mass c) percentage by volume d) ppm e) dilute solutions from stock solutions by serial dilution method	
5	2)Volumetric experiments Acidimetry and Alkalimetry Acidimetry, alkalimetry and permanganometry (two burette method may be used) a) Estimation of NaOH/KOH using standard $\text{Na}_2\text{CO}_3/\text{K}_2\text{CO}_3$ b) Estimation of $\text{HCl}/\text{H}_2\text{SO}_4/\text{HNO}_3$ using standard oxalic acid. Permanganometry a. Estimation of oxalic acid. b. Estimation of Fe^{2+} c. Estimation of nitrite	
	3)Open ended experiments (Familiarise the use of any two online simulation software)-suggestions Use of Online simulation software PhET to construct. a. Atoms of different elements (till atomic number 20) b. Build a molecule (HCl , H_2O , NH_3 , CH_4 , Benzene) c. Rutherford scattering simulation.	
	4. Familiarise a few organic compounds Any 10 simple organic compounds they learn	

Essential Readings:

1. B R Puri, L R Sharma, K C Kalia, Principles of Inorganic Chemistry, Milestone publishers, New Delhi.
2. J D Lee, Concise Inorganic Chemistry, 5th Edition, Oxford University Press New Delhi, 2008.
3. F A Cotton and Wilkinson, Advanced Inorganic Chemistry, Wiley India Pvt.Ltd., 2008.
4. G D Christian, Analytical Chemistry, John Wiley and Sons.
5. G H Jeffery, J Bassett, J Mendham, R C Denny
6. Vogel's Textbook of Quantitative Chemical Analysis, 5th Edn., ELBS, 1989.
7. D A Skoog, D M West, Analytical Chemistry, An Introduction, 4th Edn., CBS Publishing Japan Ltd., 1986
8. M. K. Jain and S. C. Sharma 'Modern Organic Chemistry' 3rd Edition, Visal Publishing Company Co.
9. K. S. Tewari and N. K. Vishnoi 'Organic Chemistry', 3rd Edition, Vikas Publishing House
10. B. S. Bahl 'Advanced organic Chemistry', S. Chand.
11. R. T. Morrison and R. N. Boyd, 'Organic Chemistry', 6th Edition - Prentice Hall of India.
12. I. L. Finar 'Organic Chemistry', Vol.- 1, Pearson Education
13. P. S. Kalsi' 'Organic Reactions and their Mechanisms'' New Age International Publishers
14. Peter Sykes, 'A Guidebook to Mechanism in Organic Chemistry', Pearson Education

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.

Employability for the Course: The course enhances employability of the students by equipping them with essential knowledge and practical skills in Chemistry