KU2DSCCHE114: FOUNDATIONS IN PHYSICAL AND ORGANIC CHEMISTRY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100	KU2DSCCHE114	4	75

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

Course Description: This course offers an exploration of fundamental chemistry concepts. Students will delve into topics such as thermodynamics, organic chemistry, stereochemistry, ionic equilibrium and analytical techniques.

Course Prerequisite: system, surroundings, organic chemistry, molecular geometry, volumetry experiments.

Course Outcomes:

MODULE	UNIT	DESCRIPTION	HOURS
1		**THERMODYNAMICS**	**10**
	1	**Thermodynamics -** Basic concepts– System – surroundings – open, closed and isolated systems – Isothermal – isochoric and isobaric process – work – heat – energy – internal energy – Heat capacity at constant volume (Cv) and at constant pressure (Cp) – relation between Cp and Cv	
	2	First law– The second law – Enthalpy-Entropy-and Free energy-Criteria for reversible and irreversible process- Gibbs –Helmholtz equation (no derivation) concepts of spontaneous and non-spontaneous processes.	
	3	**Ionic Equilibrium-** Concepts of Acids and Bases-Arrhenius, Lowry-Bronsted and Lewis concepts, ionization of weak electrolytes. pH and pOH values. Buffer solutions and calculations of their pH.	
	4	Henderson equation (numerical problems expected). Hydrolysis of salt – degree of hydrolysis and hydrolytic constant.	

2		**BASICS OF ORGANIC CHEMISTRY AND AROMATICITY**	**10**
	1	Classification of organic compounds – functional groups, Homologous series –Nomenclature of organic compounds	

	2	IUPAC system of nomenclature of hydrocarbons (alkane, alkene and alkynes), halo compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids, acid halides, anhydrides, esters, amides, amines, nitriles, nitro, cyclic, heterocyclic compounds and bicycloalkanes	
	3	Bond fission – homolysis and heterolysis – carbocation – carbanion – and free radicals	
	4	Aromaticity-Huckel's rule. Structure of benzene.	

3	**STEREOCHEMISTRY**		**10**
	1	Isomerism – general – stereoisomerism – optical isomerism – chirality – plane polarized light – specific rotation.	
	2	Enantiomerism – recemization – diastereo isomer – optical activity of lactic acid and tartaric acid – meso tartaric acid – resolution.	
	3	Conformational isomerism – ethane, propane and cyclohexane – chair and boat forms- stability	
	4	Geometrical isomerism – causes – maleic acid and fumaric acid – 1-butene and 2-butene stability.	

4	**ANALYTICAL CHEMISTRY AND GOOD LABORATORY PRACTICES**		**10**
	1	**Redox titration-** Permanganometry, Dichrometry, Cerimetry, Iodometry and Iodimetry	3
	2	**Solvent extraction:** Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation	2
	3	**Chromatographic Separation techniques**	**5**

		Chromatography: Classification, principle and efficiency of the technique. Paper, column and thin layer chromatography, Gas-liquid chromatography, HPLC	

	TEACHER SPECIFIC MODULE- **QUANTITATIVE AND CHROMATOGRAPHIC ANALYSIS PRACTICALS**	**30**
	Total 7 experiments may be done. Out of this 2 may be from permanganometry and 2 from dichrometry. Remaining 3 experiments can be from solvent extraction, /chromatography sections according to teachers' choice.	
5	1**Permanganometry** a. Estimation of oxalic acid. b. Estimation of Fe^{2+} c. Estimation of Nitrite **Dichrometry** 1.Estimation of Fe^{2+}, $FeSO_4.7H_2O$/Mohr's salt using internal indicator 2.Estimation of Fe^{2+}, $FeSO_4.7H_2O$/Mohr's salt using external indicator	10
	Teacher Specific Module(suggestions) **2. Solvent Extraction** a. Sugar-Organic Acid Mixture. b. Separation of Polyphenols from Plant extracts c. Curcumin extraction from Turmeric d. Lignin extraction from Tree bark	10
	3.Chromatographic Experiments. 6. Setting up a thin layer plate, Iodine chamber for chromatographic separation 7. Setting up paper (both horizontal and vertical) chromatography	10

	8. Column packing and elution in Column chromatography 9. Separation of simple organic compounds (o-nitrophenol and p-nitrophenol) using different chromatographic techniques 10. Separation of plant pigments using TLC, Paper and Column Chromatography	

Essential Readings:

1. P. W. Atkins and Julio de Paula, "Physical Chemistry," Oxford University Press
2. Jonathan Clayden, Nick Greeves, and Stuart Warren, "Organic Chemistry," Oxford University Press
3. Brian P. Atkins and Julio de Paula, "Principles of Physical Chemistry," Oxford University Press
4. Stanley E. Manahan, "Environmental Chemistry," CRC Press
5. Daniel C. Harris, "Quantitative Chemical Analysis," W. H. Freeman
6. Theodore L. Brown, H. Eugene LeMay, Bruce E. Bursten, Catherine J. Murphy, and Patrick Woodward, "Chemistry: The Central Science," Pearson
7. Morrison and Boyd, "Organic Chemistry," Prentice Hall
8. Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, "Principles of Instrumental Analysis," Cengage Learning

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**