

KU8DSCCHE403: PHYSICAL CHEMISTRY –VII

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
VIII	DSC	400	KU8DSCCHE403	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 comprises of modules on reaction kinetics, electroanalytical instrumentation, corrosion, applied electrochemistry and physical chemistry practicals

Course Prerequisite: Knowledge on chemical kinetics, corrosion

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand various theories of chemical kinetics and its applications in different reactions.	U
2	Understand the theory and applications of various electroanalytical techniques.	U
3	Evaluate advanced theoretical models of corrosion	E
4	Understand the chemistry of batteries, super capacitors, LED etc	U
5	Acquire skills in physical chemistry practicals.	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	1	3	0	3	1	1
CO 2	3	1	3	0	1	3	0
CO 3	3	0	3	2	2	3	2
CO 4	3	1	3	2	0	3	2
CO 5	3	0	3	0	2	3	0

Course Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
		REACTION KINETICS	17
	1	1 Review of basic principles-complex reactions-reversible-parallel-consecutive and branching reactions-principles of microscopic reversibility	
	2	Theories of reaction rates-collision theory-steric factor-potential energy surfaces- Transition state theory-Eyring equation-comparison of two theories	
	3	Thermodynamic formulation of reaction rates- Significance of ΔG^* , ΔH^* , ΔS^* volume of activation- Effect of pressure and volume on the velocity gas reaction	
	4	Unimolecular reaction-Lindmann Hinshelwood mechanism and RRK theories-Fast reaction-relaxation, flow method-flash photolysis-Magnetic and resonance method- Theoretical calculation of energy of activation	

ELECTROANALYTICAL INSTRUMENTATION		10
2	1	Voltammetry -Amperometry, biamperometry
	2	Dropping Mercury Electrode, Polarization – Concentration polarization, Half wave Potential and Diffusion current (Significance), Ilkovic equation, Advantages of polarographic analysis – Applications
	3	Cyclic voltammetry
	4	Electrogravimetry

CORROSION		8
3	1	Thermodynamics of corrosion and electrode potentials. EMF of a cell- measurement- emf calculation of half-cell potential-Nernst equation
	2	Basis of Pourbaix diagrams- Diagrams of water, Fe, and Al. Limitations of Pourbaix diagrams
	3	Kinetics of corrosion- Polarization and corrosion rate. Measurement of corrosion rate. Measurement of polarization- causes of polarization. Calculation of IR drops in an electrolyte. Influence of polarization on corrosion rate.
	4	Polarization diagram of corroding metals. Calculation of corrosion rate from polarization data. Theory of cathode protection. Passivity

APPLIED ELECTROCHEMISTRY		10
4	1	Energy storage devices: Batteries- Working of Lithium-ion battery.
	2	Basics of supercapacitors, Classification with examples

	3	Electrostatic double layer capacitors (EDLC) and Pseudo capacitors-working and principle	
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	TEACHER SPECIFIC MODULE-PHYSICAL CHEMISTRY PRACTICALS-V	30
	<i>Directions: Total 5 experiments to be done. Two from kinetics and any 3 from Polarimetry and spectrophotometry according to teacher's choice</i>	
5	1.Chemical kinetics a) Saponification of ethyl acetate – determination of specific reaction rate, $K_2S_2O_8$, and KI system b) Iodination of acetone in acid medium – determination of the order of reaction with respect to iodine and acetone 2.Polarimetry a) Determination of specific and molar optical rotations of glucose, fructose, and sucrose b) Determination of the concentration of a glucose solution c)Inversion of cane sugar in the Presence of HCl-Study of the Kinetics d)Determination of the specific rate of the reaction e) Determination of concentration of HCl 3) Spectrophotometry a) Verification of the Beer Lamberts law b) Determination of equilibrium constants of acid-base indicators c)Determination of concentration of a solution of $K_2Cr_2O_7$ (or $KMnO_4$) d)Simultaneous determination of Mn and Cr in a solution of $KMnO_4$ and $K_2Cr_2O_7$ e) Investigation of complex formation between Fe (III) and thiocyanate	

Essential Readings:

- 1 Physical Chemistry – A molecular Approach: Mc Quarrie, J. D. Simon, Viva Books Pvt Ltd.
2. Fundamentals of molecular spectroscopy: C. N. Banwell and E M Mc Cash, Mc Graw -Hill
3. A Textbook of Physical chemistry: K. L. Kapoor, Volume 4, Macmillan India Ltd.
4. Physical Chemistry, I. N. Levine, Tata Mc Graw Hill.
- 5.Elements of Physical chemistry: Puri, Sharma and Pathania, Vishal Publishing Co.
- 6.Physical Chemistry, K. J. Laidler, John H.Meiser.
- 7.Physical Chemistry: P.W. Atkins, Oxford University Press.
8. Chemical Kinetics: K J Laidler, Pearson publications
- 9) Instrumental methods of analysis: H Kaur, Pagathi publisher

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.