

KU6DSCCHE303: PHYSICAL CHEMISTRY- IV

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
VI	DSC	300	KU6DSCCHE303	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 electrical conductance, electromotive force, solid state, crystallography and a teacher specific module on physical chemistry practicals

Course Prerequisite: Basic idea about electrochemistry and solid-state chemistry

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the mechanism of electrical conductance, theories of electrical conductance, and conductometric titration.	U
2	Design different types of electro chemical cell and able to calculate its potential.	A
3	Use scientifically different types of electrodes for pH measurement.	A
4	Comprehensive understanding about the laws of crystallography	U
5	Develop skill in practical chemistry from laboratory	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	3	0	0	3	0
CO 2	3	3	3	0	3	3	1
CO 3	3	3	3	0	3	3	0
CO 4	0	0	0	3	0	3	1

Course Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	ELECTRICAL CONDUCTANCE		16
	1	Introduction -Mechanism of electrical conduction – Arrhenius theory – The laws of electrolysis – Faraday’s law and its significance	
	2	Transference Number – True and apparent transport numbers Determination by Hittorf’s method and moving boundary method	
	3	Equivalent conductance and Molar conductance -Effect of Dilution on conductance – Effect of dielectric constants of solvents	
	4	Ionic mobilities – Kohlrausch’s Law – applications – Mobilities of Hydrogen and Hydroxyl ions – Diffusion and ionic mobility- Activity and activity coefficient – standard state ionic activities and activity coefficient – ionic strength	

	5	Debye – Huckel Theory – Ionic atmosphere – Debye – Huckel limiting law – Temperature dependence of ionic conductance-Debye Falkenhagen effect-Wein effect (definition only)	
	6	Determination of solubilities by conductance measurements – conductometric titrations – conductance in non-aqueous solvents.	

	ELECTROMOTIVE FORCE-I		8
2	1	Electrochemical cell-Daniell cell – Reversible and Irreversible cell – Single electrode potential – EMF of cells – Standard potential and standard emf – Standard Hydrogen electrode and calomel electrode – Types of electrodes	
	2	Electrode reaction – cell reaction -Nernst equation for electrode potential and emf of the cell – Electrochemical series – IUPAC sign convention	
	3	Application of Gibb's Helmholtz equation to galvanic cells – Calculation of ΔG , ΔH , ΔS and equilibrium constant from emf data – The standard cells – Weston Cadmium cell and its emf-Fuel cells. (Hydrogen-oxygen, hydrocarbon-oxygen)	

	ELECTROMOTIVE FORCE-II		12
3	1	Concentration cells – Electrode and electrolytic concentration cells with and without transference and their emfs	
	2	Liquid junction potential – Elimination of liquid junction potential – salt bridge	
	3	Application of potential measurements – Determination of solubility product, ionic product of water, transport number.	
	4	pH determination – Hydrogen, Quinhydrone electrode and glass electrode –advantages and disadvantages. Potentiometric titration – redox indicators	

	SOLID STATE & CRYSTALLOGRAPHY		9
4	1	Laws of crystallography – Law of constancy of interfacial angles – Law of constancy of symmetry – Law of rationality of indices	
	2	Isomorphism and polymorphism- Miller indices- diffraction of X-rays- Laue equation- Bragg's Law Determination of internal structure of crystals by X-ray diffraction methods – derivation of Bragg's equation	
	3	Bragg's rotating crystal method and Debye Scherrer Powder diffraction method, indexing of reflections	
	4	Crystal structure of NaCl – anomalous nature of diffraction pattern of KCl. Co-ordination Number – Efficiency of packing – Cubic and Hexagonal packing – Radius ratio rule – Tetrahedral and Octahedral voids.	

	TEACHER SPECIFIC MODULE		
	PRACTICALS		30
5	<i>Directions:</i> Minimum 4 experiments must be done.		
	1. POTENTIOMETRIC TITRATIONS a) Acid base titration (Strong acid Vs strong base)		
	2. COLORIMETRY Verification of Beer-Lambert law for KMnO_4 , determination of the concentration of the given solution		
	3. CONDUCTOMETRY (Open ended)		
	a) Conductometric titrations of strong acid vs strong base b) strong acid Vs weak base c) weak acid Vs strong base		

Essential Readings:

1. Physical Chemistry: Puri, Sharma and Pathania, Vishal Publishing Co
2. An introduction to Electrochemistry: Samuel Glasstone
3. Physical Chemistry: N. Kundu & S.K. Jain, S. Chand & Company

4. Advanced electrochemistry: Giridhar Sharma
5. Physical Chemistry: W.J. Moore, Orient Longmans.
6. Physical Chemistry: K. J. Laidler, John H.Meiser
7. Modern electrochemistry: John O M Pockris and Amulya KN Reddy Volume I
8. Solid State Chemistry: L E Smart, E A Moore, CRC press
9. A textbook of Physical chemistry: A S Negi, S C Anand, New age international publications
10. Physical Chemistry: G W Castellan, Narosa publications
11. Physical Chemistry: G K Vemulapalli, PHI publications

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.