

KU7DSCCHE405: PHYSICAL CHEMISTRY - VI

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
VII	DSC	405	KU7DSCCHE405	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-		30	70	100	2

Course Description: Course comprises modules on Electro Chemistry, statistical thermodynamics, quantum statistics and solid state

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Contextualize the relation between quantum mechanics and thermodynamics	U
2	Apply the molecular partition functions	A
3	Derive and compute thermodynamic functions from partition functions	U
4	Develop an idea of different properties of solids, focusing on electric and magnetic properties	A
5	To understand about the climatic changes and atmospheric parameters	U

***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	2	3	2	3	3	3
CO 2	3	1	3	1	2	3	3
CO 3	3	1	3	1	2	3	3
CO 4	3	2	3	2	3	2	3
CO 5	3	1	2	2	3	3	3

Course Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	ELECTROCHEMISTRY-I		8
		Introduction- the nature of electrolytes– Ionic mobilities- ion activity- ion-ion and ion -solvent interaction. Equilibrium properties of electrolyte solutions. Electrolytes of the first and second kind, - Influence of pressure and temperature on ion conductance-Walden’s equation- Abnormal ion conductance-	4
		a) Derivation of Debye-Huckel Onsager equation- the validity of Debye-Huckel-Onsager equation for aqueous and non-aqueous solution- Deviation from Onsager Equation-Conductance ratio and Onsager equation-Dispersion of conductance at high frequencies-Triple ion conductance minima	4

2	ELECTROCHEMISTRY-II		10
		Equilibria in electrolytes-Association constant Ion-association-dissociation constant--- Activities and activity coefficient in electrolytic solutions. -Debye-Huckel limiting law and its various form, qualitative and quantitative tests of Debye-Huckel limiting equation	4
		Osmotic coefficient- solubility product principle-solubility in the presence of common ion-Activity coefficient and solubility measurement	2
		Butler Volmer equation for simple electron transfer reaction-Transfer coefficient- Exchange current density Rate constants- Tafel equation and its significance	4

3	STATISTICAL THERMODYNAMICS -II AND QUANTUM STATISTICS		18
	1	Partition function and thermodynamic functions- Partition function and equilibrium constants - Equation of state – Sackur Tetrode Equation- Statistical formulation of the third law of thermodynamics	6
	2	Need for quantum statistics, Bose-Einstein statistics: Bosons-Bose Einstein distribution law, Bose-Einstein condensation-liquid helium	6
	3	Fermi- Dirac statistics: Fermions- Fermi- Dirac distribution law- application to electrons in metals- Thermionic emission. Comparison of three statistics	6

4	SOLIDSTATE		12
	1	Perfect and imperfect crystals. crystal defects-point defects-Schottky and Frenkel defects-nonstoichiometric defects. Classification -point defects, line and plane defects, vacancies-.	4
	2	Thermodynamics and calculation of number of defects of Schottky and Frenkel defects and formation of colour centres, non-stoichiometric defects	4
	3	Identification of unit cells from systematic absence in diffraction pattern- structure of simple lattice - X-Ray intensities-structure factor and its relation to intensity and electron density-phase problem	4

5	TEACHER SPECIFIC MODULE		12
	<i>Directions: Photochemistry and photocatalysis or any other topic relevant to the course can be included</i>		
	PHOTOCHEMISTRY &PHOTOCATALYSIS		
	Photochemistry – consequences of light absorption – The Jablonski diagrams – Radiative and nonradiative transition – Light absorption by solutions – Lambert		

	– Beer Law – Laws of photochemistry – The Grotthus – Draper law – Stark – Einstein law – Quantum efficiency /Quantum yield – Experimental determination of quantum yield – High and low quantum yield - Photochemical rate law – Energy transfer in photochemical reactions – Photo sensitization-application in photosynthesis (brief idea only) - quenching – Chemiluminescence – Lasers-Colorimetry - Instrumentation of photocolormeter -applications -Photo catalysis	
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Essential Readings:

1. Bockris and Reddy-“Modern electrochemistry”-Springer
2. S.Glasstone-“Theoretical electrochemistry”-East-West Books
3. L.I.Anthropov-“Theoretical electrochemistry”-Mir publishers
4. M.C.Gupta-“Elements of Statistical Thermodynamics-New age international
5. L.K Nash-“Elements of Statistical Thermodynamics-Addision Wesley publishing
6. KistinandSorfuran- “A course on statistical thermodynamic”-Academic 1971
7. D.A. McQuarie- “Statistical thermodynamic”-HarperandRow1973
8. D.K. Chakraharth- “Solid state chemistry”-New age publication
9. I.V. Azaroof-“Introduction to solids”-McGraw Hill.
10. Lesley E.Smart and Elaine A.Moore."Solid state chemistry an introduction" Third edition, 2005. Taylor and Francis group.
11. A.R.West, Solid State Chemistry and its Applications, (1984) John Wiley and Sons, Singapore

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		70
Continuous Evaluation		30
a)	Test Paper*	12
b)	Assignment	6
c)	Seminar	6
d)	Viva-Voce	6
Total		100

*Average mark of the best two written tests may be considered for internal mark.