

P.B.SIDDHARTHA COLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
I SEMESTER
W.E.F 2022-23 (R22 Regulations)

Title of the Paper: PHYSICAL CHEMISTRY

Course Code	22CH1T4	Course Delivery Method	Class Room / Blended Mode - Both
Credits	4	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction:2017-2018	Year of Offering: 2022 - 23	Year of Revision:----	Percentage of Revision: 0 %

S.No	COURSE OUTCOMES	PO'S
	After the completion of the course, Students will be able to	
1	Recall the basic concepts of thermodynamics, surface chemistry, electrochemistry, chemical Kinetics and potentiometry in detail.	2
2	Apply the spontaneous and non spontaneous reaction and derive various thermodynamic and Chemical kinetic derivations.	1,7
3	Describe the physical significance of thermodynamics, chemical kinetics and electrochemistry in Explaining the chemical properties and reactivity of molecules.	1,6
4	Analyse the important techniques of surfaces with the help of ESCA, Auger electron spectroscopy and potentiometric techniques of complexometric, neutralization, oxidation and reduction Titrations.	1,7

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	Thermodynamics – I Classical thermodynamics - Brief review of first and second laws of thermodynamics - Entropy change in reversible and irreversible processes - Entropy of mixing of ideal gases - Entropy and disorder – Free energy functions - Gibbs-Helmholtz equation - Maxwell partial relations - Conditions of equilibrium and spontaneity - Free energy changes in chemical reactions: Van't Hoff reaction isotherm - Van't Hoff equation - Clausius Clapeyron equation - partial molar quantities - Chemical potential - Gibbs- Duhem equation - partial molar volume - determination of partial molar quantities - Fugacity - Determination of fugacity - Thermodynamic derivation of Raoult's law.	12
II	Surface phenomena and phase equilibria - Surface tension - capillary action - pressure difference - across curved surface (young - Laplace equation) - Vapour pressure of small droplets (Kelvin equation) - Gibbs-Adsorption equation - BET equation - Estimation of surface area - catalytic activity of surfaces – ESCA , X- ray fluorescence and Auger electron spectroscopy. Surface active agents - classification of surface active agents - Micellization - critical Micelle concentration (CMC) - factors affecting	12

	the CMC of surfactants, microemulsions - reverse micelles - Hydrophobic interaction.	
III	Electrochemistry – I - Electrochemical cells - Measurement of EMF - Nernst equation – Equilibrium constant from EMF Data - pH and EMF data - concentration cells with and without transference – Liquid junction potential and its determination - Activity and activity coefficients - Determination by EMF Method - Determination of solubility product from EMF measurements. Debye Huckel limiting law and its verification. Effect of dilution on equivalent conductance of electrolytes - Anomalous behaviour of strong electrolytes. Debye Huckel-Onsagar equation - verification and limitations, conductometric titrations.	12
IV	Chemical kinetics - Methods of deriving rate laws - complex reactions - Rate expressions for opposing, parallel and consecutive reactions involving unimolecular steps. Theories of reaction rates -collision theory - Steric factor - Activated complex theory - Thermodynamic aspects – Unimolecular reactions - Lindemann's theory - Lindemann-Hinshelwood theory. Reactions in solutions - Influence of solvent - Primary and secondary salt effects - Elementary account of linear free energy relationships - Hammett - Taft equation - Chain reactions - Rate laws of H_2-Br_2 , photochemical reaction of $H_2 - Cl_2$, Decomposition of acetaldehyde and ethane - Rice-Herzfeld mechanism.	12
V	Potentiometry: Advantages of potentiometric methods - Reference electrode - Standard hydrogen electrode .Acid- alkali or Neutralisation titration, Oxidation – reduction titrations, Precipitation titrations, complexometric titrations, Methods of end point location (Graphical, Differentiation method, Pinkhof- Treadwell method). Calomel electrode -Indicator electrodes: Metal-metal ion electrodes - Inert electrodes -Membrane electrodes - theory of glass membrane potential - Direct potentiometry, potentiometric titrations - Applications.	12

Reference Books:

1. Physical chemistry, G.K.Vemulapalli (Prentice Hall of India).
2. Physical chemistry, P.W.Atkins. ELBS
3. Chemical kinetics - K.J.Laidler, McGraw Hill Pub.
4. Text book of Physical Chemistry, Samuel Glasstone, Macmillan pub.
5. Polymer Science, Gowriker, Viswanadham, Sreedhar
7. Elements of Nuclear Science, H.J.Arniker, Wiley Eastern Limited.
8. Quantitative Analysis, A.I. Vogel, Addison Wesley Longmann Inc.
9. Physical Chemistry-G.W.Castellan, Narosa Publishing House, Prentice Hall
10. Physical Chemistry, W.J.Moore, Prentice Hall
11. Polymer Chemistry – Billmeyer

Course Focus: Employability.

M.Sc. DEGREE EXAMINATION

FIRST SEMESTER

Paper-IV :: Physical Chemistry - I

Time: 3 hours

Maximum Marks: 70

SECTION – A

Answer all the questions. Each question carries 4 marks.

(5x4M=20M)

1. (a) Explain the second law of thermodynamics. (CO-2, L - 2)

(Or)

- (b) Write the Gibbs Duham equation and describe all the terms present. (CO-2, L - 2)

2. (a) Discuss briefly the surface active agents. (CO-2, L - 2)

(Or)

- (b) Explain the micro emulsions in brief. (CO-2, L - 2)

3. (a) Write the nernst equation and describe all the terms present in it. (CO-2, L - 2)

(Or)

- (b) Explain the principle in conductometric titrations. (CO-2, L - 2)

4. (a) Write the mechanism in Lindemann's theory of unimolecular reactions. (CO-2, L - 2)

(Or)

- (b) Describe the mechanism in decomposition of Acetaldehyde. (CO-2, L - 2)

5. (a) Describe the advantages of potentiometric methods over classical methods. (CO-2, L - 2)

(Or)

- (b) Explain the calomel electrode in short. (CO-2, L - 2)

SECTION – B

(10x5=50M)

UNIT - I

6. (a) Derive the Maxwell's thermodynamic relations. (CO-2, L - 2) **(Or)**

(b) What is fugacity? Give its physical significance. Describe the different methods of determination of fugacity. (CO-3, L - 3)

UNIT - II

7. (a) Discuss the theory involved in ESCA. How are this techniques used in the analysis of surfaces? (CO-2, L - 2)

(Or)

(b) What is CMC? How is it determined? What are the factors effecting CMC? (CO-2, L - 2)

UNIT - III

8. (a) What is activity? How is activity coefficient determined from EMF? (CO-2, L - 2)

(Or)

(b) What is the effect of dilution on equivalent conductance of electrolytes? (CO-2, L - 2)

UNIT – IV

9. (a) Discuss the kinetics of consecutive reactions. (CO-2, L - 2)

(Or)

(b) Discuss the kinetics of $H_2 - Br_2$ reaction in detail. (CO-3, L - 3)

UNIT - V

10. (a) Explain the theory of precipitation titrations in detail. (CO-2, L - 2)

(Or)

(b) Discuss the potentiometric titrations in detail. (CO-2, L - 2)
