P.B.SIDDHARTHA COLLEGE OF ARTS & SCIENCE

DEPARTMENT OF CHEMISTRY

M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)

II SEMESTER

W.E.F 2022-23 (R22 Regulations)

Title of the Paper: ADVANCED PHYSICAL CHEMISTRY

Course Code	**22CH2T3**	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 :2017-18	Year of Offering:	Year of Revision:	Percentage of Revision: 0%

S.No	COURSE OUTCOMES	PO`S
	After completion of the course, the student will be able to :	
1	Remember the concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry.	1,2,7
2	Understand the concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry.	1,2,7
3	Apply the concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry in research and other allied fields.	1,2,4
4	Analyze the role and significance of concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry.	1,2,7
5	Evaluate the role of concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry in understanding the named concepts in chemistry.	1,2,7

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	**Third law of Thermodynamics and Statistical thermodynamics**: Nernst Heat theorem - Third law of thermodynamics - Its limitations - Determination of absolute entropy -Thermodynamic probability and most probable distribution, Entropy and probability - Boltzmann-Plank equation. Ensembles, Maxwell-Boltzmann distribution, Fermi-Dirac statistics, Bose Einstein statistics. Partition function - calculation of thermodynamic properties in terms of partition function - Chemical equilibrium and partition function - Translational, rotational and electronic partition function - Entropy of Monoatomic gases (Sackur-Tetrode equation).	12

II	**Polymer chemistry and Raman Spectroscopy:** Classification of polymers - Free radical, ionic and Zeigler -Natta Polymerization - kinetics of free radical polymerization -Techniques of polymerization - Glass transition temperature - Factors influencing the glass transition temperature. Number average and Weight average, Molecular weights –molecular weights determinations – Membrane Osmometry, Light scattering phenomenon. Classical and quantum theories of Raman effects, pure rotational, vibrational and Vibrational- rotational Raman spectra, selection rules, mutual exclusion principle.	12
III	**Electro Chemistry-II:** Reference electrode - Standard hydrogen electrode. Calomel electrode -Indicator electrodes: Metal-metal ion electrodes - Inert electrodes -Membrane electrodes - theory of glass membrane potential, potentiometric titrations, advantages of potentiometric titrations, Conductometric titrations. Electrode potentials - Double layer at the interface - rate of charge transfer - Decomposition potential - Over potential - Tafel plots - Derivation of Butler- Volmer equation for one electron transfer - electro chemical potential.	12
IV	**Chemical kinetics and Photo chemistry:** Branching Chain Reactions – Hydrogenoxygen reaction - lower and upper explosion limits - Fast reactions - Study of kinetics by flow methods - Relaxation methods - Flash photolysis. Acid base catalysis – protolytic and prototropic mechanism. Enzyme catalysis - Michelis-Menten kinetics. **Photochemistry:** Quantum yield and its determination, Actinometry, Reactions with low and high quantum yields, Photo sensitization, Exciplexes and Excimers, Photochemical equilibrium, Kinetics of collisional quenching - Stern- Volmer equation.	12
V	**Radioactivity and Isotopes:** Introduction to radioactivity, properties of alpha rays, beta rays and gamma rays, theory of radioactive disintegration, rate of disintegration, Geiger – Nuttal rule, radioactive equilibrium. Isotopes - radioactive and non-radioactive isotopes, group displacement law. Analysis of isotopes – Aston's mass spectrograph, Dempster's method, Bainbridge's method. Separation methods of isotopes. Applications of Radio isotopes in Industry and medicine.	12

Text books/ 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. Statistical Thermodynamics - M.C.Gupta.
6. Polymer Sceince, Gowriker,Viswanadham, Sreedhar.
7. Quantitative Analysis, A.I. Vogel, Addison Wesley Longmann Inc.
8. Physical Chemistry by G.W.Castellan, Narosa Publishing House, Prentice Hall.
9. Physical Chemistry by W.J. Moore, Prentice Hall.
10. Polymer Chemistry by Billmayer.
11. Fundamentals of Physical Chemistry by K K. Rohatgi-Mukherjee. Wiley Eastern Ltd publications.
12. Statistical Thermodynamics by M.Dole.
13. Fundamentals of photochemistry by Rohatgimukherjee, New Age international Publications.
14. Essentials of Nuclear chemistry by H.J.Armikar, New Age international Publications

Course Focus: Employability & **E**ntrepreneurship

M.Sc. DEGREE EXAMINATION
SECOND SEMESTER
Course Code : 22CH2T3
Paper-IV :: Advanced Physical Chemistry

Time: 3 hours **Maximum Marks: 70**

SECTION – A **(5x4M=20M)**

1 (a). Explain briefly Nernst Heat theorem. (CO-2, L-2)

(Or)

(b). Discuss Third law of thermodynamics in short. (CO-2, L-2)

2 (a). Demonstrate Classification of polymers. (CO-3, L-3)

(Or)

(b). Describe the Free radical polymerization with appropriate mechanism. (CO-2, L-2)

3(a). Explain Branching Chain Reactions in short. (CO-2, L-2)

(Or)

(b). Discuss briefly Hydrogen oxygen reaction with appropriate mechanism. (CO-2, L-2)

4(a). Discuss briefly Double layer at the interface. (CO-2, L-2)

(Or)

(b). Expalin over potential in short. (CO-2, L-2)

5(a). What is radioactivity? Describe the properties of alpha rays. (CO-2, L-2)

(Or)

(b). Discuss briefly the theory of radioactive disintegration. (CO-2, L-2)

SECTION – B **(5x10M=50M)**

UNIT - I

6.(a) Derive Fermi-Dirac statistics. (CO-3, L-3)

(b) Derive Bose Einstein statistics. (CO-3, L-3)

(Or)

(c) Derive Chemical equilibrium interms of partition function. (CO-3, L-3)

(d) Derive Entropy of Monoatomic gases (Sackur-Tetrode equation). (CO-3, L-3)

UNIT – II

7.(a) Illustrate Zeigler -Natta Polymerization with suitable example. (CO-3, L-3)

(Or)

(b) Differentiate between Number average and Weight average weight of a polymer in detail. (CO-3, L-3)

UNIT – III

8.(a) Discuss with a neat labelled diagram Standard hydrogen electrode and Calomel electrode in detail. (CO-2, L-2)

(Or)

(b) Demonstrate the conductometric titrations in detail with a neat labelled graphs.(CO-3, L-3)

UNIT - IV

9.(a) What are Fast reactions ? Discuss the Study of kinetics by flow methods and Relaxation methods With a neat labeled diagram. (CO-3, L-3)

(Or)

(b) Differentiate between protolytic and prototropic mechanisms of Acid Base catalysis. (CO-3, L-3)

UNIT - V

10.(a) Explain the rate of disintegration in detail. (CO-2, L -2)

(b) Discuss the Geiger – Nuttal rule. (CO-2, L -2)

(Or)

(c) Discuss the radioactive equilibrium. (CO-2, L -2)

(d) What are isotopes? Illustrate radioactive and non-radioactive isotopes in detail. (CO-3, L-3)