

Subject Code: 02CY0303**Subject Name: Physical Chemistry****B.Sc. Sem - V****Objectives:**

- To study Electrolysis and electrical conductance, its introduction and types.
- To make students capable of understanding the basics of pH and potentiometry.
- To study the concept of energy, chemical equilibrium and law of thermodynamics.
- To study the conductometry and colorimetry.

Credits Earned: 6 Credits**Course Outcomes:** After completion of this course, student will be able to

- Understand the Electrolysis and electrical conductance.
- Be aware of the basics of pH and potentiometry.
- Obtain the information regarding third law of thermodynamics, free energy and chemical equilibrium.
- Understand the basic of conductometry and colorimetry.

Pre-requisite of course: Fundamental knowledge of physical chemistry is required to better understand this course.**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
5	-	2	6	50	30	20	25	25	150

Contents

Unit	Topics	Contact Hours
1	Electrolysis and electrical conductance Introduction, types of electrolytes mechanism of electrolysis, Faraday's law, importance of Faraday's law, Conductance of electrolytes, specific conductance, equivalent conductance, molar conductance, variation of equivalent conductance with concentration, variation of conductance with temperature, measurement of electrolytic conductance, determination of cell constant, Applications of emf measurements numerical.	15
2	pH and Potentiometry Introduction and interpretation of pH metry and potentiometry, Importance of indicator and reference electrode in the measurement of EMF and pH, E.M.F. method: Study of acid – base Titration, Redox Titration, Argentometric Titration include mixture of Cl^- , Br^- , I^- with graph and proper explanation. pH metry : Definition, Interpretation of various methods of determining pH value like pH paper method (Demonstration only), potentiometric method using only hydrogen electrode as indicator electrode and calomel electrode as reference electrode to determine pH value. Weak acid strong base Titration with curve and determination of dissociation constant (K_a) of weak acid.	20
3	Free energy and chemical equilibrium Concept of entropy, entropy change in an ideal gas, entropy change in mixture of ideal gas, physical significance of entropy, concept of free energy and work function, physical significance of work function, equation for chemical affinity, Derivation of Gibbs Helmholtz equation, application of Gibbs Helmholtz equation, Third law of thermodynamics, Nernst's theorem, residual entropy, numerical.	10
4	Conductometry and Colorimetry Introduction, difference between thermal and photochemical reactions, Grothus Draper law, Lambert's law, Beer's law, Beer-Lambert's law, Transmittance, absorbance, molar absorptivity, Deviation from Beer- Lambert's law, spectrophotometric estimation, Conductometric Titration : Strong acid - strong base, Strong acid - Weak base, Weak acid – Strong base, Weak acid – Weak base, Mixture of strong acid + Weak acid - strong base, Precipitation Titration : AgNO_3 – NaCl , BaCl_2 – K_2SO_4 , $\text{Ba}(\text{OH})_2$ – MgSO_4 , numerical.	15
Total Hours		60

References:

1. A Textbook of Physical Chemistry; K. L. Kapoor
2. An Introduction to Chemical Thermodynamics; R. P. Rastogi, R. R. Misra, 6th Edition, Vikas Pub. Pvt. Ltd.
3. Physical Chemistry; G. W. Castellan, 3rd Edition, Narosa Publishing House, New Delhi.

4. Physical Chemistry; ArunBahl & J. D. Tuli, S. Chand Publishing.
5. Organic Reactions and their Mechanisms; P. S. Kalsi, New Age International Publishers.
6. Organic Chemistry; R. T. Morrison and R. N. Boyd, 6th Edition, Prentice Hall of India.
8. Concise Inorganic Chemistry; J. D. Lee, 5th Edition, Blackwell Science, London.
9. Basic Inorganic Chemistry; F. A. Cotton, G. Wilkinson
10. Principles of Inorganic Chemistry; B. R. Puri, L. R. Sharma, K. C. Kalia, Vallabh Publications, Delhi
11. Organic Chemistry; Morrison and Boyd
12. Organic Chemistry (Volume I, II & III); S. M. Mukherji, S. P. Singh, R. P. Kapoor.
13. Principles of physical chemistry; B.R. Puri, L.R. Sharma, M.S. Pathania.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	30%	25%	15%	10%	-

Potentiometry:

1. To determine the normality and dissociation constant of x N acetic acid/succinic/oxalic acid with the help of 0.1 N NaOH solution by potentiometric titration.
2. To determine the normality of HCl and CH₃COOH in the mixture with the help of 0.1 N NaOH solution by potentiometric titration.
3. To determine the concentration of KCl and solubility product of AgCl with the help of potentiometric titration.

Viscosity:

4. To determine the relative and absolute viscosity of given liquids A, B, C and D by Ostwald viscometer.
5. To determine relative and absolute viscosity of given liquid glycerine 10%, 5%, 2.5% and unknown solution by Ostwald viscometer.

Refractometer:

6. To find specific refractive index and molecular refractive index of A, B, C and D of pure liquids by using refractometer.
7. To find specific refractive index and molecular refractive index of 10%, 5%, 2.5% and unknown solution of glycerine by using refractometer.

Thermodynamics:

8. To calculate the entropy of vaporization of given liquid by kinetic approach.

Reference Books

1. An Advanced Course in Practical Chemistry, A. K. Nad, B. Mahapatra and A. Ghoshal, New Central Book Agency (P) Ltd.
2. Practicals in Physical Chemistry, P S Sindhu, Macmillan.
3. Experimental Physical Chemistry: A Laboratory Textbook, Arthur Halpern, George McBane, W. H. Freeman.

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory
5. Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.
6. All students in the laboratory must wear safety goggles and lab coats during lab session.

Supplementary Resources:

1. <http://nptel.ac.in/course.php?disciplineId=104>
2. <http://ocw.mit.edu/courses/chemistry/>
3. <http://vlab.amrita.edu/index.php?sub=2>
4. http://www.vlab.co.in/ba_labs_all.php?id=9
5. <https://www.youtube.com/user/TMPChem>
6. <https://www.youtube.com/playlist?list=PL166048DD75B05C0D>
7. <https://www.youtube.com/channel/UCqk-dmk3AOfikaFDpsZorg>
8. <https://www.youtube.com/user/PradeepKshetrapal>