| | |
|---|---|
| **INSTITUTE** | **FACULTY OF SCIENCE** |
| **PROGRAM** | **BACHELOR OF SCIENCE (CHEMISTRY)** |
| **SEMESTER** | **5** |
| **COURSE TITLE** | **PHYSICAL CHEMISTRY** |
| **COURSE CODE** | **02CY0307** |
| **COURSE CREDITS** | **4** |

**Objective:**

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

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

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

**Pre-requisite of course:**Understand essential concepts in physical chemistry.

**Teaching and Examination Scheme**

| Theory Hours | Tutorial Hours | Practical Hours | ESE | IA | CSE | Viva | Term Work |
|---|---|---|---|---|---|---|---|
| 4 | 0 | 0 | 50 | 30 | 20 | 0 | 0 |

| Contents : Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Electrolysis and Electrical Conductance**<br>Introduction, types of electrolytes mechanism of electrolysis, Faraday's law, importance of Faraday' 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 |

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| Contents : Unit | Topics | Contact Hours |
|---|---|---|
| 2 | **pH and Potentiometry**<br>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 (Ka) of weak acid. | 20 |
| 3 | **Free Energy and Chemical Equilibrium**<br>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**<br>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 : AgNO3 – NaCl, BaCl2– K2SO4,Ba(OH)2–MgSO4,numerical. | 15 |
| **Total Hours** | | **60** |

**Textbook :**


1 Electrolysis, Thermolysis And The Blend, Arthur R Hinkel, Richard W Lind, Arroway, 1968

2 An Essential Guide to Electrical Conductivity and Resistivity, Luke Lewin, Nova Science Publishers, Inc., 2019

3 Instrumental Methods of Chemical Analysis, H. Kaur, Pragati Prakashan, 2012


**References:**


1 Thermodynamics and Chemical Equilibrium, Thermodynamics and Chemical Equilibrium, Paul C. Ellgen, Createspace Independent Pub, 2014

2 Modern Electrochemistry, Modern Electrochemistry, Bockris J., SPRINGER, 2018

3 Instrumental Method of Chemical Analysis, Instrumental Method of Chemical Analysis, B K Sharma, Krishna Prakashan Media p Ltd, 2011


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**Suggested Theory Distribution:**

The suggested theory distribution as per Bloom's taxonomy is as 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 / Knowledge** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Higher order Thinking / Creative** |
| 10.00 | 20.00 | 30.00 | 30.00 | 10.00 | 0.00 |

**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, ecourses, 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-dmk3AOFtikaFDpsZorg
8. https://www.youtube.com/user/PradeepKshetrapal

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