RAGHU ENGINEERING COLLEGE

(Autonomous)
(Approved by AICTE, New Delhi, Permanently Affiliated to JNTU-GV, Vijayanagaram
Accredited by NBA (EEE, ME, ECE & CSE) & NAAC by A+ Grade)
Dakamarri, Bheemunipatnam Mandal, Visakhapatnam Dist. – 531 162 (A.P.)
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APPLIED CHEMISTRY

(Common to CSE, CSD, CSM, CSO, CSC, EEE, ECE)

Course objectives:

- To familiarize Applied Chemistry and its applications
- To train the students on the principles and applications of polymers and electrochemistry
- To elucidate the structure and bonding of molecules
- To introduce modern engineering materials and instrumental methods

Course outcomes: At the end of the course, the student will be able to

- Explain the preparation, properties, and applications of thermoplastics & thermosetting, elastomers & conducting polymers
- Compare the electrochemical methods for titrations and materials of construction for battery
- Explain basic concepts of advanced materials like superconductors, supercapacitors and nanomatrials
- Explain the fundamental concepts of quantum mechanics
- Explain the principles of spectrometry, demonstrate separation methods of solid and liquid mixtures.

UNIT I Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, with specific examples and mechanisms of polymer formation (free radical).
Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6.
Elastomers–Vulcanization of Rubber, Buna-S, Buna-N–preparation, properties and applications.
Conducting polymers – polyacetylene, mechanism of conduction and applications. Bio-Degradable polymers - Poly Vinyl Alcohol (PVA), Poly Lactic Acid (PLA).

Learning Outcomes:

At the end of the module the student will be able to

1. use different types of polymers for various applications (L2)
2. explain the preparation, properties and applications of some plastics and rubbers. (L2)
3. describe the role of vulcanization process in improving the mechanical properties of polymers. (L2)

UNIT II Electrochemistry and Applications:

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).
Primary Cells: Zinc air battery, secondary cells-Lead–acid battery and lithium ion batteries-working of the batteries including cell reactions, Fuel cells, hydrogen-oxygen fuel cell– working of the cells.

Learning outcomes:
At the end of the module the student will be able to

1. illustrate the construction of electrochemical cells. (L3)
2. classify different types of batteries. (L2)
3. apply redox principles for construction of batteries and fuel cells. (L3)

UNIT III Modern Engineering materials

Semiconductor, Band diagram in solids, semiconductor device (p-n junction diode as rectifier and transistors)
Super Conductors-Introduction, basic concept, Classifications, Applications.
Supercapacitors: Introduction, Basic Concept-Classification – Applications.
Nano materials: Introduction, Classification, preparation, properties and applications carbon nano tubes (Arc Discharge method), Fullerenes.

Learning outcomes:
At the end of the module the student will be able to

1. discuss the concepts of semiconductors and super capacitors. (L2)
2. explain the synthesis of carbon nano tubes. (L3)
3. discuss role of nanomaterials in wastewater treatment and other applications (L2)

UNIT IV Structure and Bonding Models:

Fundamentals of quantum mechanics, Schrodinger wave equation, significance of ψ and ψ^2, LCAO theory, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2, CO, N_2 and NO, calculation of bond order.

Learning outcomes:
At the end of the module the student will be able to

1. understand the fundamental concepts of quantum mechanics. (L2)
2. discuss formation molecular orbitals using LACO theory (L2)
3. illustrate the energy level diagrams of homo- and heteronuclear diatomic molecules. (L2)

UNIT V Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, Electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Learning outcomes:
At the end of the module the student will be able to

1. explain electromagnetic spectrum . (L2)
2. understand Beer-Lambert's law to make use of UV and IR spectroscopy. (L3)
3. explain the working principles of UV, IR, Chromatography and HPLC

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.M.Lehn, Supra Molecular Chemistry, VCH Publication

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APPLIED CHEMISTRY LAB

(Common to CSE, CSD, CSM, CSO, CSC, EEE, ECE)

Course Objectives:

- Verify the fundamental concepts with experiments.

Course Outcomes: At the end of the course, the students will be able to

- Demonstrate and analyse experimental skills
- Calculate water quality parameters like the hardness of water, DO etc.,
- Determine the cell constant and conductance of solutions.
- Acquire hands on knowledge on various instrumental techniques
- Prepare a commonly used polymer

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. Determination of Strength of an acid in Pb-Acid battery
3. Estimation of Ferrous Iron by Dichrometry
4. Determination of percentage Moisture content in a coal sample
5. Preparation of nanomaterials by precipitation method.
6. Conductometric titration of strong acid vs. strong base
7. Conductometric titration of weak acid vs. strong base
8. Determination of cell constant and conductance of solution
9. pH metric titration- determination of strength of strong acid vs. strong base
10. Verify Lambert –Beer's Law
11. Preparation of a polymer (Bakelite)
12. Adsorption of acetic acid by charcoal

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar