JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech-CSE – I Sem

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(20A51101T) CHEMISTRY

(CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT, ECE, EEE and IT)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches

Unit 1: Structure and Bonding Models:

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, applications to hydrogen, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation ofbond order.

Learning Outcomes:

At the end of this unit, the students will be able to

- Apply Schrodinger wave equation to hydrogen atom (L3)
- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Explain the calculation of bond order of O_2 and Co molecules (L2)
- Discuss the basic concept of molecular orbital theory (L3)

Unit 2: Modern Engineering materials:

Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic and colour.
Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.
Supercapacitors: Introduction, Basic concept-Classification – Applications.
Nanochemistry: Introduction, classification of nanometerials, properties and applications of Fullerenes, carbonnano tubes and Graphines nanoparticles.

Learning Outcomes:

At the end of this unit, the students will be able to

- Explain splitting in octahedral and tetrahedral geometryof complexes (L2).
- Discuss the magnetic behaviour and colour of coordination compounds (L3).
- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nano tubes and Graphines nanoparticles (L2).

Unit 3: Electrochemistry and Applications:

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems,

potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).
Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.
Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries-working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Learning Outcomes:

At the end of this unit, the students will be able to

- Apply Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between ph metry, potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)
- Solve problems based on cell potential (L3)

Unit 4: Polymer Chemistry:

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.
Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.
Elastomers–Buna-S, Buna-N–preparation, properties and applications.
Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

Learning Outcomes:

At the end of this unit, the students will be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylon-6,6, and carbon fibres (L2)
- Describe the mechanism of conduction in conducting polymers (L2)
- Discuss Buna-S and Buna-N elastomers and their applications (L2)

Unit 5: Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Principle and applications of pH metry, UV-Visible,IR Spectroscopies. Solid-Liquid Chromatography–TLC, retention time.

Learning outcomes:

After completion of Unit IV, students will be able to:

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles of different analytical instruments (L2)
- Explain the different applications of analytical instruments (L2)

Text Books:

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. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
4. J.M.Lehn, Supra Molecular Chemistry, VCH Publications

Course Outcomes:

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

- Compare the materials of construction for battery and electrochemical sensors (l2)
- Explain the preparation, properties, and applications of thermoplastics &thermosetting, elastomers& conducting polymers. (l2)
- Explain the principles of spectrometry, slc in separation of solid and liquid mixtures (l2)
- Apply the principle of Band diagrams in application of conductors and semiconductors (L3)