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(Permanent Affiliation by Andhra University & Approved by AICTE
Accredited by NBA (ECE, EEE, CSE, IT, Mech. Civil & Chemical) & NAAC)
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R23 APPLIED CHEMISTRY
(For I/IV B.Tech IT, CSE 2023-24)
WEF 2023-24

Course Code: 23CY1101/1102 **Credits**: 3
Instruction: 3 periods/ 1 Tutorial per week **Sessional marks**: 40
End exam: 3 hours **End exam marks**:60
Prerequisites: Chemistry at +1 and +2 level

L	T	P	E	O	Credits	Semester marks	Sessional marks
3	1	-	1	-	3	60	40

Course Objective:
Emphasizing fundamental principles and key concepts in Applied chemistry course enables students to:

- Attain a deep comprehension of the course's core objectives.
- Equips students to adeptly address dynamic challenges in the evolving engineering industry.

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

CO	Statement
1	Achieve a solid grasp of scientific concepts in water quality, error analysis, statistics, and spectrophotometry. Gain knowledge of practical principles in electrochemical devices, materials science, and engineering, and be able to explain the core principles of Green Chemistry and their relevance to biomolecules and related areas. (L2)
2	Apply acquired knowledge and skills in water quality, chemical analysis, spectrophotometry, electrochemical devices, materials science, engineering principles, and Green Chemistry to solve practical problems and make informed decisions in various real-world scenarios. (L3)
3	Analyse complex topics in water quality, chemical analysis errors, and spectrophotometry, showcasing a deep understanding of materials science and engineering principles. Assess the environmental and economic consequences of substituting traditional solvents with alternatives and conduct thorough analyses of amino acids, recognizing their pivotal role as protein constituents. (L4)
4	Excel in analyzing intricate topics related to water quality, chemical analysis errors, and spectrophotometry while displaying an exceptional command of materials science and engineering principles. (L5)
5	Cultivate advanced problem-solving skills and creativity by synthesizing innovative solutions and strategies across diverse domains: water quality, treatment, electrochemical devices, solar cells, (L6)

UNIT-I Water Technology **10 Periods**

Impurities in water - Specifications of water for domestic use (ICMR and WHO) - Hardness- Types, units of hardness, Numerical problems on hardness, Disadvantages in using hard water; Boiler troubles- Sludge & Scale formation, Internal Treatment (Carbonate, Phosphate & Calgon conditioning methods), Boiler corrosion.

Water softening method - Ion exchange resin process, advantages & disadvantages; Desalination methods - Reverse Osmosis & Electrodialysis.

Municipal water treatment - Sedimentation with coagulation, Sterilisation - Chlorination (break point chlorination), UV treatment.

Learning Outcomes (LO):

- Identify and differentiate water hardness types, understand drawbacks of hard water, and make informed decisions on water quality for domestic and industrial settings. (L1)
- Solve numerical problems on water hardness, accurately calculate hardness concentrations, and assess their potential impact on different water systems. (L2)
- Apply ion exchange resin process for water softening, ensuring cleaner water for specific uses, and understand benefits and limitations of softening techniques. (L3)
- Evaluate and compare desalination methods for potable water production, enabling informed selection based on efficiency, cost-effectiveness, and environmental impact. (L4)

Unit-II Errors in chemical analysis & Spectrophotometric Techniques **10 Periods**

Errors in chemical analysis- Mean, Median, Accuracy, Precision; types of errors, source of errors, minimize errors; statistical terms- mode, variance, standard deviation; Significant figures; statistical Analysis of chemical, health and environmental data.

Spectrophotometric techniques: Interaction of radiation and matter, Absorbance & Transmittance, absorption spectra & emission spectra, Beers-Lamberts law; Principle, instrumentation and medical applications of UV-Vis double beam spectrophotometer, flame photometer.

- Recall and understand the foundational concepts and terminology related to errors in chemical analysis, statistical terms, significant figures, and spectrophotometric techniques at a basic level. (L1)
- Comprehend the concepts related to errors in chemical analysis, statistical terms, significant figures, and spectrophotometric techniques. (L2)
- Apply the knowledge related to errors in chemical analysis and spectrophotometric techniques in practical scenarios. (L3)
- Evaluate concepts and techniques related to errors in chemical analysis and spectrophotometric methods. (L4)

UNIT-III Energy Storage Systems **10 periods**

Introduction to Electrode potentials, Electro Chemical Series; Batteries - Primary battery - Dry Cell, Secondary battery - Lead Acid battery, Lithium-ion batteries; Fuel cells - Hydrogen -Oxygen fuel cells, Applications.

Advanced batteries for Electrical vehicles - Lithium iron phosphate, Solid state battery -advantages & applications; Solar cells – Types - Polycrystalline and Thin film Solar cells, Principle, Working and Applications.

Learning Outcomes:

- Recall and identify key concepts of electrode potentials, electrochemical series, primary and secondary batteries, and fuel cells. (L1)
- Explain the principles, working mechanisms, and characteristics of batteries, fuel cells, and solar cells, showcasing a comprehensive understanding of their functions and applications. (L2)
- Analyse and compare advanced batteries in terms of advantages and applications, enabling their suitability assessment for specific requirements and contexts. (L3)
- Evaluate and synthesize knowledge of electrode potentials, battery technologies, fuel cells, and solar cells, applying critical thinking to propose innovative solutions for advancements in energy storage and sustainable energy applications. (L4)

Unit-4 Chemistry of Materials **10 Periods**

Introduction to solids, Band theory of solids, Role of dopants on band structures, organic semiconductors, Engineering Applications, Compound semiconductors; fabrication methods of semiconducting materials, wafer manufacturing, oxidation diffusion and ion implantation.
Liquid crystals- Types of liquid crystals- working of LCD, LED, OLED, Applications of liquid crystals.
Nanomaterials, Synthesis by Sol-Gel Process; Characterization of Nanomaterials - Instrumentation-working of Scanning electron microscope and Transmission electron microscope; Applications of nanomaterials.

Learning Outcomes:

- Recall and understand the fundamental concepts and terminology related to solids, semiconductors, liquid crystals, and nanomaterials.
- Comprehend and have ability to apply knowledge of materials science and engineering principles to various contexts.
- Apply and integrate knowledge materials science and engineering principles in practical contexts.
- Emphasize critical thinking, analysis, and the ability to make informed decisions based on a deep understanding of materials science and engineering principles.

Unit -5 Green Chemistry & Biomolecules **10 Periods**

Principles of Green Chemistry, Alternative solvents, Renewable feed stock-biodiesel production, Design Synthesis for Energy Efficiency - Microwave radiation, Sono Chemistry.
Biomolecules: Amino acids, classification; Nucleic Acids, Chemical composition of nucleic acids, structure of Nucleic acids, biological functions of nucleic acids.
recall and understand the foundational concepts and terminology related to Green Chemistry & its related context and biomolecules.

Learning Outcomes:

- Recall and understand the foundational concepts and terminology related to Green Chemistry & its related context and biomolecules. (L1)
- Comprehend and explain fundamental concepts and principles related to Green Chemistry Green Chemistry & its related context and biomolecules. (L2)
- Apply knowledge and concepts to practical situations, solving problems, and making informed decisions in the context of green chemistry, renewable feedstock, energy-efficient synthesis, and biomolecules. (L3)
- Analyze and evaluate the application of Green Chemistry principles in real-world scenarios, assessing their impact on reducing environmental harm.(L4)

Prescribed Text books:

1. Engineering chemistry -P. C. Jain & M.Jain - Dhanpath Rai & Sons , New Delhi.

2. Engineering Chemistry by O.G.Pallanna, Mc Graw hill, Chennai

3. Hand book of Green Chemistry and Technology; by James Clark and Duncan Macquarrie; Blackwell publishing.

4. Vogel's text book of Quantitative analysis, 5^{th} edition, G.H.Jeffery, J.Bassett, J.Mendham, R.S.Denney.

Reference Textbooks:

1. A text book of Engineering Chemistry-S.S. Dara- S.Chand & Co.New Delhi.

2. Dell, Ronald M Rand, David A J. Understanding Batteries, Royal society of Chemistry, (2001)

3. Anastas; P. T, Warner, J.C.Green Chemistry; Theory and Practice, Oxford University and Press InC., Newyork, 1998.

4. Chemistry of Biomolecules, 2^{nd} Edition, Dr.S.P.Bhutani, Routledge, Taylor & Francis Group.