SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES (AUTONOMOUS)

APPLIED CHEMISTRY QUESTION BANK

Year / Semester: I B.Tech I/II Semester
Regulation: R23
Subject and Code: 23BSC111

SYLLABUS

APPLIED CHEMISTRY (23BSC111)

(Common to EEE, ECE, CSE, IT & allied branches)

Course Educational Objectives:

1. To train the students about the concepts of quantum mechanics and molecular orbital theory
2. To familiarize knowledge and applications of modern engineering materials
3. To understand the concept of electrochemistry with its applications such as battery, fuel cells and sensors
4. To develop knowledge on the concepts and applications of polymers
5. To introduce instrumental methods such as UV, IR and chromatography with applications

UNIT I Structure and Bonding Models (9)

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II Modern Engineering materials (9)

Semiconductors, band diagram in solids, Semiconductor devices (p-n junction diode as rectifier and transistors)

Super conductors-Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon Nano tubes and Graphine nanoparticles.

UNIT III Electrochemistry and Applications (9)

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 –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV Polymer Chemistry (9)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, 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, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

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UNIT V Instrumental Methods and Applications (9)

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.

COURSE OUTCOMES:

On successful completion of the course the students will be able to		POs
CO1	Demonstrate knowledge and exhibit skills on analysis of water with industrial applications and sustainability	PO1, PO2, PO6, PO7
CO2	Demonstrate knowledge on electrochemistry with applications such as battery, and fuel cells, sensors, concepts on corrosion with its effects and sustainability	PO1, PO2, PO6, PO7
CO3	Understand concepts on polymers with applications related to society and sustainability, basic concepts on fuel with use, analysis and sustainability	PO1, PO2, PO6, PO7
CO4	Familiarize the knowledge on engineering materials for industrial applications and use	PO1, PO2, PO6
CO5	Acquire knowledge on surface chemistry and related nanomaterials for several applications	PO1, PO2, PO6

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai Publishing company, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.
3. K. Sesha Maheswaramma, Mridula Chugh, Engineering Chemistry, 4th Impression, Pearson, 2022.
4. K.N. Jayaveera. G.V. Subbareddy, C. Rama Chandraiah, Engineering Chemistry, 4/e, 2013, Tata Mc Graw Hill Education Private limited, New Delhi

Reference Books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.

Reference Websites:

1. https://www.youtube.com/watch?v=zVZ9c6EXfTA
2. https://archive.nptel.ac.in/courses/104/106/104106137/
3. https://nptel.ac.in/courses/113104082
4. https://nptel.ac.in/courses/104105039
5. https://nptel.ac.in/courses/104106132

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CO-PO MAPPINGS:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2				2	2					
CO2	3	2				2	2					
CO3	3	2				2	2					
CO4	3	2				2						
CO5	3	2				2						
CO*	3	2				2	2					

Max Marks: 10

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S.No.	CO	Questions	BT
Unit I: (Unit Name)			
1	**CO1**	Explain the π-molecular orbital energy of 1,3-Butadiene	**AN**
2	**CO1**	**Explain the π-molecular orbital energy of Benzene**	**AN**
3	**CO1**	Construct the energy level diagram of O_2 and find their magnetic character, and bond . order	**CR**
4	**CO1**	Outline the Molecular orbital of any one homonuclear and heteronuclear diatomic molecule.	**CR**
5	**CO1**	Construct the energy level diagram of CO and find their magnetic character, and bond . order	**CR**
6	**CO1**	Derive the Schrodinger wave equation	**AU**
7	**CO1**	Discuss briefly about molecular orbital theory	**AU**
8	**CO1**	Apply the Schrödinger wave equation to particle in 1-dimensional box.	**RM**
9	**CO1**	**Construct Energy level diagram of O2 and Benzene**	**CR**
10	**CO1**	**Construct Energy level diagram of CO and 1,3 Butadiene**	**CR**
11	**CO1**	**Compare bonding molecular orbital and anti-bonding molecular orbital**	**AU**

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S.No.	CO	Questions	BT
		Unit II: (Unit Name)	
1	**CO1**	**Explain the band theory of solids with neat band diagram.**	**AN**
2	**CO1**	.Explain the properties of nanomaterials. (or) Formulate the allotropes of nanocarbon structures and their applications. Mention the increased order of electrical conductance of allotropes of nanocarbon structures.	**AN**
3	**CO1**	**Write the difference between type I and type II superconductor.**	**RM**
4	**CO1**	**Summarize types of supercapacitors and their applications.**	**CR**
5	**CO1**	Give the classification of semiconductor and types	**UN**
6	**CO1**	**List of the applications of nanomaterials. With any two examples**	**CR**
7	**CO1**	Write a short note on nanomaterials and its classification.	**RM**
8	**CO1**	Explain about Rectifier and Rectification its types.	**AN**
9	**CO1**	**Explain transistor and its classifications**	**AN**
10	**CO1**	Explain the types of superconductors and applications	**AN**
11	**CO1**	**Discuss the important applications of fullerenes and Graphene**	**AN**

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S.No.	CO	Questions	BT
Unit III: (Unit Name)			
1	**CO3**	Describe the construction and working of Hydrogen-Oxygen fuel cell and list its application.	**AU**
2	**CO3**	Illustrate the construction and working of lithium-ion batteries with their cell reactions	**CR**
3	**CO3**	Discuss the titration curve obtained in conductometric titration ?	**AU**
4	**CO3**	What is electrochemical cell? Explain the electrochemical cell with neat diagram.	**RM**
5	**CO3**	Derive Nernst equation. Explain the terms	**AN**
6	**CO3**	Describe the construction and working of PEMFC and list its application.	**AU**
7	**CO3**	Define Battery and. types of batteries with examples	**AP**
8	**CO3**	Titration curve obtained in conductometric strong acid Vs Weak base	**CR**
9	**CO3**	**What is difference between primary cell and Secondary cell**	**UN**
10	**CO3**	**Define fuel cell .give an examples of H2,O2 Fuel cell**	**RM**
11	**CO3**	. Derive Nernst equation for single electrode potential	**AN**

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S.No.	CO	Questions	BT
Unit IV: (Unit Name)			
1	**CO4**	Discuss the free radical mechanism of chain growth polymerization .	**AN**
2	**CO4**	Outline the properties and applications of Bakelite	**CR**
3	**CO4**	Explain the following preparation, properties and uses of a) Buna-S b) Buna-N	**AP**
4	**CO4**	Explain the preparation, properties and uses of the following a) PVC b) Teflon) Nylon6,6.	**AP**
5	**CO4**	What is polymerization and its types and application Methods	**RM**
6	**CO4**	Compare the thermos plastics and thermosetting Plastics	**CR**
7	**CO4**	What is biodegradable polymer? Explain the preparation and properties of PGA and PLA	**RM**
8	**CO4**	Describe mechanism of conductance of polyaniline and polyacetylene conducting polymer	**UR**
9	**CO4**	Outline the properties and applications of Bakelite, Nylon6,6.	**CR**
10	**CO4**	Discuss the free radical mechanism of additions polymerization	**AP**

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11	**CO4**	11. Explain the preparation and properties of PGA and PLA	**UN**

S.No.	CO	Questions	BT
Unit V: (Unit Name)			
1	**CO5**	Describe the High performance Liquid Chromatography (HPLC) and applications	**RE**
2	**CO5**	Explain the principle and applications of UV-Visible spectroscopy)	**UN**
3	**CO5**	Describe the various vibrations in IR spectroscopy and Instrumentation	**AP**
4	**CO5**	Illustrate the various electronic transitions in UV visible spectroscopy	**AN**
5	**CO5**	Instrumentation of UV visible spectroscopy and working ,principal	**EV**
6	**CO5**	Instrumentation of IR spectroscopy	**CR**
7	**CO5**	Explain absorption of radiation (beer lambert's law)	**AN**
8	**CO5**	What is chromatography and its classifications	**CR**
9	**CO5**	Describe the High performance Liquid Chromatography (HPLC) and applications	**UN**

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10	**CO5**	**Explain the Electromagnetic spectrum**	**L3**
11	**CO5**	**Draw the block diagram of HPLC and explain functions of different pats and mention the its applications.**	**L3**

Note: L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating, and L6-Creating

Instruction to Faculty Members:

The Six Levels of Bloom's Taxonomy:

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory (e.g., list, define, name, locate).
2. **Understanding:** Constructing meaning, explaining ideas, or concepts (e.g., summarize, interpret, classify, compare).
3. **Applying:** Using information in new situations or implementing procedures to solve problems (e.g., solve, use, demonstrate, implement).
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure (e.g., contrast, categorize, distinguish, diagram).
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing (e.g., judge, critique, justify, defend, argue).
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure (e.g., design, construct, develop, formulate).

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