R.M.K. ENGINEERING COLLEGE

(*An Autonomous Institution*)

RSM Nagar, Kavaraipettai – 601 206.

Date: 17.12.2024

B.E. / B.Tech - Model Exam – December 2024

First Semester

Computer Science and Engineering / Computer Science and Design / Artificial Intelligence and Data Science / Information Technology

24CH101- Engineering Chemistry (Lab Integrated)

COs	Course Outcome : The students, after the completion of the course, are expected to ....
CO1	To gain a comprehensive knowledge on polymers utilized in various industrial sectors.
CO2	To knowledge on the fundamental principles of energy storage devices.
CO3	To gain insights into the basic concepts and applications of chemical sensors and cheminformatics.
CO4	To identify the different types of smart materials and explore their applications in Engineering and Technology.
CO5	To assimilate the preparation, properties and applications of nanomaterials in various fields.

Time : 3 Hours **Max. Marks : 100**

Answer ALL Questions

Part-A (10 x 2 = 20 Marks)

1. Define the term "functionality" in polymer chemistry
2. Write any two point on the influence of molecular weight on the mechanical properties of a polymer
3. What is the fundamental difference between a primary and a secondary battery?
4. With suitable example, write the significance of the electrochemical series in predicting redox reactions.
5. Discuss the importance of cheminformatics in drug discovery.
6. Write the principle behind the working of a glass electrode in a pH sensor.
7. What is a chromogenic material?
8. Critically analyze the significance of chromogenic materials in display technologies.
9. How the bottom-up synthesis process differs from the top-down approach in nanomaterial production.
10. List two top-down synthesis processes for nanomaterials.

Part – B (5 x 16 = 80 Marks)

11.a. i). Describe the preparation process of Polyethylene, discussing its types (HDPE and LDPE), and elaborate on its industrial applications in packaging. (8)
ii) Compare and contrast Polyethylene terephthalate (PET) with other packaging polymers, highlighting its preparation, unique properties, and industrial relevance. (8)

Or

11.b. i) Analyze the unique properties of Teflon that make it suitable for specialized industrial applications. Discuss its chemical structure and performance characteristics. (8)
ii) Explain the concept of piezoelectric effect and the applications of piezoelectric polymers. (8)

12.a. Elaborate on the production of hydrogen through photoelectrocatalytic water splitting. Analyze the scientific principles, current technological challenges, and potential future developments in this method of hydrogen generation.

Or

12.b. Examine the construction, working principle, and performance characteristics of a Ni-metal hydride battery. Compare its strengths and weaknesses with traditional battery technologies used in electric vehicles.

13.a. Elaborate on the principle, design, and functioning of a glucose sensor used in healthcare. Analyze its importance in diabetes management, technological challenges, and recent innovations in biosensor technology.

Or

13.b. Compare and contrast different types of chemical sensors used in healthcare and industrial applications. Critically evaluate their sensing mechanisms, sensitivity, specificity, and potential limitations. Discuss the future prospects of chemical sensor technologies in addressing complex monitoring challenges.

14.a. Investigate the preparation, properties, and applications of Super Absorbent Polymers (SAP). Focus on polyacrylic acid and sodium polyacrylate, discussing their molecular structure, absorption mechanisms, and significance in various industrial and healthcare applications.

Or

14.b. Examine the types of chromogenic materials. Provide an in-depth analysis of their working principles, applications in chemical and biological detection, and their role in smart window technologies and light-modulating devices.

15.a. Examine the applications of carbon nanotubes in electronics and information technology. Provide an in-depth analysis of their electrical, mechanical, and thermal properties that make them unique for advanced technological applications.

Or

15.b. Compare and contrast the applications of nanomaterials across multiple industries, including construction, transportation, and energy sectors. Critically evaluate how nanocomposites and nanomaterials are transforming traditional technological approaches and addressing complex industrial challenges.

Knowledge Level (Blooms Taxonomy)					
K1	Remembering (Knowledge)	**K2**	Understanding (Comprehension)	**K3**	Applying (Application of Knowledge)
K4	Analysing (Analysis)	**K5**	Evaluating (Evaluation)	**K6**	Creating (Synthesis)

Knowledge Level and Course Outcome – Question wise Mapping										
Part	Part A									
Question	1	2	3	4	5	6	7	8	9	10
K Level	**K1**	**K3**	**K1**	**K5**	**K2**	**K4**	**K2**	**K5**	**K2**	**K2**
CO	**CO1**	**CO1**	**CO2**	**CO2**	**CO3**	**CO3**	**CO4**	**CO4**	**CO5**	**CO5**
Part	Part B									
Question	11 (a)	11(b)	12 (a)	12 (b)	13 (a)	13 (b)	14 (a)	14 (b)	15 (a)	15 (b)
K Level	**K3**	**K3**	**K4**	**K4**	**K5**	**K5**	**K2**	**K2**	**K2**	**K2**
CO	**CO1**	**CO1**	**CO2**	**CO2**	**CO3**	**CO3**	**CO4**	**CO4**	**CO5**	**CO5**

MODEL EXAM 2024-25

KEY

Part A

1. Functionality: means the number of sites present for bonding in a molecule. Ex: ethene, ethylene glycol
2. (1). Higher MWT improves tensile strength and toughness due to increased molecular entanglement.
   (2) Lower MWT reduces mechanical strength, enhancing processability.
3. Primary Battery**:** Single-use, non-rechargeable; chemical reactions are irreversible (e.g., alkaline batteries).
   Secondary Battery**:** Rechargeable; chemical reactions are reversible (e.g., lithium-ion batteries)
4. Significance – feasibility of cell, prediction hydrogen displacement from acid, prediction of displacement reaction etc
5. Data Management: Cheminformatics efficiently handles vast chemical and biological data, enabling better organization and analysis of molecules. Drug Design**:** It accelerates drug discovery through virtual screening, molecular modeling, and prediction of drug-likeness properties.
6. The glass electrode works on the principle of ion-exchange and the generation of a potential difference due to hydrogen ion activity. The potential across the glass membrane is proportional to the pH of the solution and measured against a reference electrode using the Nernst equation
7. Chromogenic material: They change colour when subjected to a certain variation in temperature, light, pressure, etc.
8. Chromogenic materials are significant in display technology for their ability to change color or opacity under external stimuli (e.g., light, heat, voltage), enabling energy-efficient, dynamic displays.
9. Any two differences of top down and bottom up approach.
10. Laser abalation and CVD

Part B

11 a. (i) Preparation (4 marks), types (2 marks), application in packing (2 marks)
(ii) Preparation (4 marks), application in packing (2 marks) comparison (2 marks)

11 b.(i) Preparation (2 marks), properties (4 marks) structure (2 marks)
(ii) Piezoelectric effect (2 marks), properties and applications (6 marks)

12 a. Principle (2 marks),Preparation (4 marks), diagram (4 marks) advantages disadvantages and applications(6 marks)

12b. Construction(4 marks), Working principle(6 marks), and advantages (4 marks), Comparison (2 marks).

13 a. Principle (2 marks), diagram(4 marks) and functioning (6 marks) significance and challenges (4 marks)

13 b. Comparison with glucose sensor,CO_2 sensor and alcohol sensor (16 marks)

14a. PAA- Preparation (4 marks), properties (2 marks) applications (2marks)
SPA- Preparation (4 marks), properties (2 marks) applications (2marks)

14 b. Chromogenic materials- types (8 marks), principle (2 marks) applications (2marks)

15a. CNT application-Electronics and IT (4 marks), Electrical(4 marks), Mechanical(4 marks), thermal(4 marks)

15 b. Applications of Nano materials- Construction (4 marks), transportation (4 marks)and energy(4 marks) Nanocomposites application (4 marks)