R.M.K. ENGINEERING COLLEGE

(An Autonomous Institution)

RSM Nagar, Kavaraipettai – 601 206

Date : 27.10.2024

First Internal Assessment Test – October 2024

1st Semester - B.E. / B.TECH.

24CH101 - Engineering Chemistry (Lab Integrated)

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

COs	Course Outcome : The students, after the completion of the course, are expected to ....
CO1	To examine the role of polymers in different industrial sectors.
CO2	To identify the suitability of batteries for various fields.
CO3	To apply the fundamental principles of chemical sensors, cheminformatics and their applications across various industries.
CO4	To analyze the types of smart materials used in various engineering fields.
CO5	To explore the applications of nanomaterials in various fields, considering their advantages and limitations.
CO6	To integrate the concepts of chemistry for various engineering applications.

Time : 3 Hours **Answer ALL Questions** **Max. Marks : 100**

Part-A (10 x 2 = 20 Marks)

1. Define functionality of polymers and give the functionality of vinyl chloride monomer in polyvinyl chloride
2. Outline the methods to determine the molecular weight of polymers
3. Give the preparation of Teflon.
4. Highlight how can molecular weight of polymer be related to glass transition temperature.
5. Quote the specific properties of electroactive polymers
6. Differentiate electrolytic cells and electrochemical cells
7. Mention the advantages of alkaline cells over dry cells
8. Express a method of recycling of Li-ion batteries by direct cycling method
9. Predict how flow batteries differ from other primary and secondary batteries
10. Write the cell reactions in Ni-hydride battery

Part – B (5 x 16 = 80 Marks)

11.a. Glass transition temperature is an important property of polymers. Articulate how they differ from melting point and write in detail the factors influencing Glass Transition Temperature of Polymers.(16)

Or

11.b. Present how Low Density and High Density Polyethylene are prepared. Justify how are these polymers selected for commercial applications based on their properties(16)

12.a. Enumerate the synthesis of epoxy resins from their precursors, properties and applications of epoxy resins (16)

Or

12.b. Present the theoretical and practical concepts of piezoelectric polymers, the underlying mechanism necessary for materials processing with emphasis on its special properties and applications. (16)

13.a. Sketch the importance of electrochemical series and its applications in electrochemistry with illustration. (16)

Or

13.b. Illustrate the construction and working principle and applications of Lead acid battery and comment on the voltage output obtained (16)

14.a. Fuel cells are the cells of the future world. Discuss in detail the construction, working principle and applications of any one prominent fuel cell, emphasizing its advantage in space vehicles. (16)

Or

14.b. Comment on the production of green fuel Hydrogen by different methods. Enumerate the role of Hydrogen fuel in sustainability and green environment(16)

15.a. Biodegradable polymer research is blooming up due to stringent implementation of Sustainable Development Goals in industrial sectors. Explain with illustration how biodegradable polymers like polylactic acid helps in attaining circular economy (16)

Or

15.b. Many energy storage devices with advances are advancing into commercial markets. Justify with detail explanation the environmental effects of different energy storage devices, and how E -vehicles can set minimize environmental pollution (16)

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**	**K1**	**K1**	**K2**	**K1**	**K2**	**K2**	**K2**	**K2**	K1
CO	**CO1**	**CO1**	**CO1**	**CO1**	**CO1**	**CO2**	**CO2**	**CO2**	**CO2**	**CO2**
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**	**K3**	**K3**	**K3**	**K3**	**K3**	**K3**	**K5**	**K5**
CO	**CO1**	**CO1**	**CO1**	**CO1**	**CO2**	**CO2**	**CO2**	**CO2**	**CO1**	**CO2**

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R.S.M Nagar, Kavaraipettai, Gummidipoondi Taluk, Thiruvallur Dt- 601206.
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Accredited by NAAC with A+ Grade/ All the eligible UG Programs are accredited by NBA, New Delhi

24CH101-ENGINEERING CHEMISTRY
FIRST INTERNAL ASSESSMENT TEST ANSWER KEY

PART-A

<table>
<tr><th>Q.No</th><th>Answer</th></tr>
<tr><td>1</td><td>Functionality:
The number of reactive sites or bonding sites or number of reactive functional groups present in a monomer is known as its functionality.
Functionality of Vinyl chloride monomer in PVC is 2</td></tr>
<tr><td>2</td><td>Molecular weight of polymer can be determined by viscometry, light scattering and sedimentation equilibrium methods.</td></tr>
<tr><td>3</td><td>Preparation of Teflon:
It is prepared by emulsion polymerisation of tetrafluoroethylene under pressure in the presence of benzoyl peroxide catalyst.
$n\ F_2C{=}CF_2 \xrightarrow[\text{Under pressure}]{\text{Benzoyl peroxide}} -(F_2C-CF_2)_n-$
Tetrafluoroethylene — Polytetrafluoroethylene</td></tr>
<tr><td>4</td><td>Higher molecular weight polymers generally have higher Tg. This is because longer polymer chains entangle more, making the material more resistant to flow and thus raising the Tg.</td></tr>
<tr><td>5</td><td>Properties of electroactive polymer:
• Electro active polymers or EAP’s are polymers that exhibit a change in size or shape, when stimulated by an electric charge.
• Versatile mechanical, electrical, electro-mechanical properties.
• High mechanical flexibility, low density, structural simplicity, and low cost.</td></tr>
<tr><td>6.</td><td>
<table>
<tr><th>S.No.</th><th>Electrolytic cell</th><th>Electrochemical Cell</th></tr>
<tr><td>1.</td><td>Electrical energy is converted into chemical energy.</td><td>Chemical energy is converted into electrical energy.</td></tr>
<tr><td>2.</td><td>The anode is positive.</td><td>The anode is negative.</td></tr>
</table>
</td></tr>
</table>

	3.	The cathode is negative.	The cathode is positive.
	4.	Electrons are supplied to the cell.	Electrons are drawn from the cell.
7	**The main advantages of alkaline cell over dry cell are:** 1. There is no leakage, since Zn does not dissolve readily in a basic medium. 2. The shelf life of alkaline battery is longer than the dry battery, because there is no corrosion of Zn. An alkaline battery is expected to power a device for a period of two to four months (except in a few low-drain applications). 3. Alkaline battery maintains its constant voltage, as the current is drawn from it. 4. Alkaline batteries are environment-friendly, which can be disposed as trash and do not require active collection and recycling.		
8	**Methods used for recycling of Li-ion battery by direct cycling method:** 1. Thermal Regeneration Process 2. Chemical Treatments 3. Electrochemical Methods 4. Mechanical Treatment **5.** Chemical Reconditioning		
9	Fuel cells or flow batteries work like batteries, but they do not run down or need recharging. They produce electricity and heat as long as fuel is supplied		
10	**At Anode:** Metal hydride is oxidized with the liberation of electrons which then combine with hydroxide ion to form water. $MH_{2\,(s)} + 2OH^-_{(aq)} \longrightarrow M_{(s)} + 2\,H_2O_{\,(l)} + 2\,e^-$ **At Cathode:** Nickel oxyhydroxide is reduced to Ni^{2+} which further combine with H_2O to form $Ni(OH)_2$. $2\,NiO(OH)_{(s)} + 2\,H_2O_{(l)} + 2\,e^- \longrightarrow 2\,Ni(OH)_{2(l)} + 2\,OH^-_{(aq)}$ **Overall cell reaction during use (discharging):** $\mathbf{MH_{2\,(s)} + 2\,NiO(OH)_{(s)} \longrightarrow M_{(s)} + 2\,Ni(OH)_{2(l)}}$		

PART-B

Question number		Mark distribution
11	a	**(i)Glass transition temperature** Definition-2 marks Properties-6 marks Factors – 8 marks
	b	(i)Polyethylene Preparation-6 marks Properties – 4 marks Commercial applications-6 marks
12	a	(i)Epoxy resin Preparation-6 marks Properties-4 marks Applications-6 marks
	b	(i) Piezoelectric polymer: Preparation-6 marks Properties-4 marks Applications-6 marks
13	a	(i)EMF Series: Defintion with table – 4 marks Significance (any 6) -12 marks
	b	**(i)Lead acid battery:** Description -4 marks Diagram -4 marks Equation - 4 marks Adv. Dis. Adv. Applns. -2 marks
14	a	**(i) Fuel cell:** Description -4 marks Diagram -4 marks Equation - 4 marks Adv. Dis. Adv. Applns. -2 marks
	b	**(i)Hydrogen fuel** Production methods (PEC & PC)-6+6= 12 marks Role of sustainability and green Env. = 4 marks
15	a	**(i) Biodegradable polymer:** Preparation, Properties and Applications -12 marks To attain circular economy and implementation of SDG - 4 marks
	b	(i)Environmental effects of different Energy storage devices -13 marks E-Vehicle minimize Env. Pollution -3 marks

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