



**Academic year 2024-2025 (Odd Sem)
(CIE-II FOR I SEM CS STREAM)**

DEPARTMENT OF CHEMISTRY

| | | | |
|--|----------|--------------------|--------|
| Date | 11.12.24 | Sem - I | CIE-II |
| Course Code | CM211IA | Maximum Test Marks | 50 |
| Course Name | CSMD | Duration | 90 Min |
| CHEMISTRY OF SMART MATERIALS AND DEVICES (CSMD) | | | |

| Test Questions | | M | BTL | CO |
|----------------|---|---|-----|----|
| 1 | Outline the process of recycling lead-acid batteries and highlight the key steps involved in material recovery, along with necessary chemical reactions. | 7 | 2 | 1 |
| 2 | Solid electrolyte interphase is very essential in lithium-ion battery. Justify. Illustrate the construction and working of Lithium cobalt oxide battery along with structural components, electrochemical reactions during charge and discharge cycles. | 7 | 3 | 3 |
| 3 | Illustrate the following i) Pyrometallurgy ii) Hydrometallurgy iii) Effect of heavy metal ions on health | 7 | 2 | 1 |
| 4 | Outline the constructions and working of Quantum dot sensitized solar cells along with neat labelled diagram. | 7 | 2 | 3 |
| 5 | How batteries are different from supercapacitor? Explain the construction of EDLC with neat labelled diagram. | 7 | 3 | 2 |
| 6 | Outline the principle of organic photovoltaics along with its construction and working with a labelled diagram. | 7 | 2 | 2 |
| 7 | Describe the CVD method for synthesizing carbon nanotubes (CNTs) with a neat labelled diagram. Justify the role of inert gas in above process. | 8 | 3 | 4 |

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

| Marks Distribution | Particulars | CO1 | CO2 | CO3 | CO4 | L1 | L2 | L3 | L4 | L5 | L6 |
|-----------------------|-------------|-----|-----|-----|-----|----|----|----|----|----|----|
| | Max Marks | 14 | 14 | 14 | 08 | - | 28 | 22 | | | - |

Academic year 2024-2025 (Odd Sem)
(CIE-I FOR I SEM CS STREAM)

DEPARTMENT OF CHEMISTRY

| | | | |
|---|----------|--------------------|--------|
| Date | 04.11.24 | Sem - I | CIE-I |
| Course Code | CM211IA | Maximum Test Marks | 50 |
| Course Name | CSMD | Duration | 90 Min |
| CHEMISTRY OF SMART MATERIALS AND DEVICES (CSMD) | | | |

| Test Questions | | M | BTL | CO |
|----------------|--|---|-----|----|
| 1 | Polyethene is non-biodegradable, whereas Polylactic acid is biodegradable, justify. Outline the synthesis of Polylactic acid and mention any two applications of it. | 7 | 5 | 1 |
| 2 | Describe the key principles of green chemistry, focusing on the importance of prevention, less hazardous chemical synthesis, and the use of safer solvents and auxiliaries. Provide relevant case study to highlight the application of these principles. | 7 | 2 | 3 |
| 3 | The following are two different methods used to synthesize Hydrazine. Among them, suggest the greener method based on atom economy and prevention of waste. (Given atomic weight of Na=23, H= 1, O= 16, Cl= 35.5 and N= 14) (i) $\text{NaOCl} + 2\text{NH}_3 \rightarrow \text{NH}_2\text{NH}_2 + \text{NaCl} + \text{H}_2\text{O}$ (ii) $\text{H}_2\text{O}_2 + 2\text{NH}_3 \rightarrow \text{NH}_2\text{NH}_2 + 2\text{H}_2\text{O}$ | 7 | 3 | 1 |
| 4 | Discuss the important characteristics of Hydrogels. Provide examples of natural and synthetic hydrogels. List any two biomedical applications. | 7 | 2 | 3 |
| 5 | Outline the steps involved in the determination of pKa of weak acid using pH measurements along with its principle. | 7 | 2 | 2 |
| 6 | Assume you are performing a conductometric titration of 45 ml Hydrochloric acid solution (HCl) with standard sodium hydroxide (0.75N). As you add standard NaOH to the HCl solution, you observe the changes in conductivity. Based on the principle of conductometric titration: (i) Predict the nature of graph (ii) Justify the nature of graph before and after equivalence point. (iii) Assume equivalence point is 1.6 ml, then calculate the amount of HCl in 750 ml solution (gram equivalent weight of HCl = 36.5) | 7 | 3 | 2 |
| 7 | Explain the estimation of amount of copper in E-waste volumetrically along with principle, procedure and calculation. | 8 | 2 | 4 |

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

| Marks | Particulars | CO1 | CO2 | CO3 | CO4 | L1 | L2 | L3 | L4 | L5 | L6 |
|--------------|-------------|-----|-----|-----|-----|----|----|----|----|----|----|
| Distribution | Max Marks | 14 | 14 | 14 | 08 | - | 29 | 14 | - | 7 | - |

USN

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | R | V | a | 4 | C | S | 2 | 5 | 4 |
|---|---|---|---|---|---|---|---|---|---|

RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

I Semester B. E. Regular / Supplementary Examinations Feb/Mar 2025

Common to AI / BT / CS / CY / CD / IS

CHEMISTRY OF SMART MATERIALS AND DEVICES


Time: 03 Hours

Maximum Marks: 100

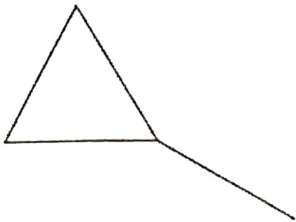
Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer SIX full questions from Part B. In Part B question number 2 and 11 are compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8 & 9 and 10.

PART-A**M BT CO**

| | | | | | |
|---|------|--|----|---|---|
| 1 | 1.1 | Write any one requirement of biodegradable polymers. | 01 | 2 | 3 |
| | 1.2 | Why hydrogels are finding enormous applications in medicine industry? | 01 | 1 | 2 |
| | 1.3 | Define Topological index of a molecule. | 01 | 2 | 3 |
| | 1.4 | Compute the platt number for the following structure.  | 01 | 2 | 3 |
| | 1.5 | Name any one polymeric material used in electronic memory devices. | 01 | 3 | 4 |
| | 1.6 | Comment on the role of polarizer in LCD's. | 01 | 5 | 2 |
| | 1.7 | Write any one requirements of a conducting polymer. | 01 | 2 | 3 |
| | 1.8 | Name the reducing agent used in the synthesis of Graphene oxide in modified Hummer's method. | 01 | 3 | 1 |
| | 1.9 | Write any one example for reserve battery. | 01 | 3 | 1 |
| | 1.10 | Justify the role of Solid Electrolyte Interphase in Lithium-Ion battery. | 01 | 2 | 4 |

PART-B

| | | | | | |
|----|---|--|----|---|---|
| 2 | a | Mention any three principles of green chemistry and explain in detail with suitable examples. | 07 | 3 | 3 |
| | b | Briefly explain the different steps involved in recycling of Lead acid batteries using pyro-metallurgical recycling method. | 07 | 2 | 4 |
| 3 | a | Discuss the following types of intermolecular forces with suitable examples: i) Van der Waals forces ii) Hydrogen bonding | 07 | 6 | 3 |
| | b | Construct the vertex-adjacency and edge-adjacency matrix for methyl cyclopropane.  | 07 | 6 | 3 |
| OR | | | | | |

| | | | | | |
|----------------------|---|--|----|---|---|
| 4 | a | Discuss non-covalent interactions that results in the stabilization of the protein molecule. | 07 | 6 | 2 |
| | b | Outline the steps involved in the analysis of quantitative structure-property relationships (QSPR). | 07 | 2 | 2 |
| 5 | a | What is Light Emitting Electro chemical cell (LECs)? Discuss the device fabrication and working principle of LECs. | 07 | 1 | 2 |
| | b | Explain the different steps involved in the manufacturing of semiconductor chips used in electronic devices. | 07 | 2 | 2 |
| OR | | | | | |
| 6 | a | How OLEDs are different from LCDs? Discuss the device fabrication and working principle of OLEDs. | 07 | 1 | 2 |
| | b | Mention the different types of memory devices. Explain any three of it. | 07 | 3 | 1 |
| 7 | a | Mention any two applications of Polyaniline and also discuss the synthesis of conducting Polyaniline. | 07 | 3 | 2 |
| | b | Construct the experimental setup and explain the procedure for the synthesis of carbon nanotubes by modified CVD method. | 07 | 6 | 4 |
| OR | | | | | |
| 8 | a | With the help of schematic representation, explain the working principle and application of piezoelectric sensor. | 07 | 2 | 2 |
| | b | Discuss the device fabrication and working principle of electrochemical sensors for the glucose detection. | 07 | 6 | 3 |
| 9 | a | Write a short note on Voltage (EMF), Energy density, and Cycle life of the battery. | 07 | 3 | 3 |
| | b | Explain the working principle of $Li - CoO_2$ battery with the help of neat labeled diagram. | 07 | 2 | 1 |
| OR | | | | | |
| 10 | a | With a neat labeled diagram, explain the construction, and working principle of the DSSCs. | 07 | 2 | 4 |
| | b | Mention any one difference between battery & supercapacitor. Explain the construction & working of EDLC type super capacitor. | 07 | 4 | 3 |
| LAB COMPONENT | | | | | |
| 11 | a | Outline the instrumentation, procedure and calculations involved in the estimation of copper from E-waste using colorimetric technique. | 10 | 2 | 4 |
| | b | Discuss the potentiometric principle and procedure used for the estimation of iron in the given solution using $K_2Cr_2O_7$. Explain the chemistry behind the variation of potential using required graphs. | 10 | 6 | 4 |



Academic year 2024-2025 (ODD Sem)
(IMPROVEMENT TEST FOR I SEM CS STREAM)

DEPARTMENT OF CHEMISTRY

| | | | |
|--|------------|--------------------|--------|
| Date | 02.12.2024 | Sem - I | CIE-IT |
| Course Code | CM211IA | Maximum Test Marks | 50 |
| Course Name | CSMD | Duration | 90 Min |
| CHEMISTRY OF SMART MATERIALS AND DEVICES (CSMD) | | | |

| Test Questions | | M | BTL | CO |
|----------------|---|---|-----|----|
| 1 | Summarize the principles of green chemistry (a) catalysis, (b) the use of renewable feedstocks, with suitable examples. How do these principles contribute to sustainability in environmental applications? | 7 | 2 | 1 |
| 2 | Justify the replacement of polythene bag by polylactic acid and illustrate the synthesis of polylactic acid. List any two biomedical applications. | 7 | 3 | 3 |
| 3 | Using the principles of redox chemistry, examine the steps involved in the conversion of graphite to reduced graphene oxide by modified Hummers method. Also, list the electronic and energy device applications of graphene. | 7 | 2 | 1 |
| 4 | Propose the semiconductor material extracted from sand. Interpret the importance of different steps involved in the manufacturing of semiconductor chips. | 7 | 4 | 3 |
| 5 | Based on the concept of sustainable chemistry, interpret the properties, functionalities, and biomedical applications of hydrogels. | 7 | 3 | 2 |
| 6 | Identify the suitable electrodes and construct the smart electrochemical glucose sensor. Highlight the functionalities of electrodes and enzymatic reactions in glucose detection. | 7 | 3 | 2 |
| 7 | Describe an experiment to evaluate the copper composition in PCB e-waste volumetrically. Analyze the copper composition in PCB e-waste, while considering its environmental impact for sustainable e-waste management. | 8 | 3 | 4 |

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

| Marks | Particulars | CO1 | CO2 | CO3 | CO4 | L1 | L2 | L3 | L4 | L5 | L6 |
|--------------|-------------|-----|-----|-----|-----|----|----|----|----|----|----|
| Distribution | Max Marks | 14 | 14 | 14 | 08 | | 14 | 21 | 08 | | |
