



Siddaganga Institute of Technology, Tumakuru-572 103

(An Autonomous Institution affiliated to VTU, Belagavi, Approved by AICTE, New Delhi)

First Semester Bachelor of Engineering Examinations February 2024

Chemistry for Electrical and Electronics Engineering Stream

Time: 3 Hours

Max. Marks: 100

Note : 1. Revealing of Identity in any form in the answer book will be treated as malpractice.
2. Answer any five questions choosing one full question from each unit.

Unit - I

- | | M | BL | CO | PO | PSO |
|---|---|----|----|----|-----|
| 01 a) Describe the experimental details and give the mathematical derivation for determination of the pH of a solution using glass electrode. | 7 | 2 | 1 | 1 | |
| b) What is a concentration cell? Give an example. Derive an expression for the emf of a concentration cell. | 7 | 2 | 1 | 1 | |
| c) Evaluate the voltage of the cell, $\text{Mg} \text{Mg}^{++}(\text{aq}) \text{Cd}^{++}(\text{aq}) \text{Cd}$ at 25°C , when $[\text{Cd}^{++}] = 7.0 \times 10^{-11}\text{M}$, $[\text{Mg}^{++}] = 1.0\text{M}$ and $E^\circ_{\text{cell}} = 1.97\text{V}$. | 6 | 5 | 1 | 1 | |

OR

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|---|---|---|---|---|--|
| 02 a) What is single electrode potential? Derive Nernst equation for single electrode potential. | 7 | 2 | 1 | 1 | |
| b) What is a reference electrode? With a neat diagram, explain the construction and working of Ag-AgCl electrode. | 7 | 2 | 1 | 1 | |
| c) A voltaic cell consists of a rod of copper immersed in a 10.0M solution of CuSO_4 and a rod of iron immersed in a 0.1M solution of FeSO_4 . Evaluate the voltage for the cell. Given, $E^\circ_{\text{Cu}^{++}/\text{Cu}} = 0.34\text{V}$ and $E^\circ_{\text{Fe}^{++}/\text{Fe}} = -0.44\text{V}$. | 6 | 5 | 1 | 1 | |

Unit - II

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|--|---|---|---|---|--|
| 03 a) Identify the anode, cathode and electrolyte for the following batteries:
i) Ni-Cd battery ii) Lithium-ion battery | 7 | 1 | 2 | 2 | |
| b) State Beer-Lambert's law. Derive the mathematical expression for Beer-Lambert's law. | 7 | 2 | 2 | 2 | |
| c) What is colorimetry? Discuss the instrumentation of colorimetry. | 6 | 2 | 2 | 2 | |

OR

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|---|---|---|---|---|--|
| 04 a) Explain the variation of conductance with graphs in the following cases.
i. Mixture of strong acid and weak acid against strong base
ii. Strong acid against weak base. | 7 | 2 | 2 | 2 | |
| b) What is a battery? Discuss the construction and working of Lead acid battery. | 7 | 2 | 2 | 2 | |
| c) $7.25 \times 10^{-5}\text{M}$ solution of potassium permanganate has a transmittance of 44.1% when measured in a 2.10 cm cell at wavelength of 525 nm. Evaluate (a) the absorbance of the solution (b) the molar absorptivity of KMnO_4 . | 6 | 4 | 2 | 2 | |

Unit - III

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|--|---|---|---|---|--|
| 05 a) What are fuel cells? Describe the construction and working of $\text{CH}_3\text{OH}-\text{O}_2$ fuel cell. Mention its uses. | 7 | 2 | 3 | 2 | |
| b) Give the production of Biodiesel with the chemical reactions. Mention their advantages. | 7 | 2 | 3 | 2 | |
| c) Explain the synthesis of nano TiO_2 by hydrothermal method. | 6 | 2 | 3 | 2 | |

OR

- 06** a) What are nano materials? Outline the synthesis of Nano ZnO by combustion method. 7 2 3 2
- b) i. Distinguish between Top down and bottom up process.
 ii. Evaluate the % atom economy for the following reaction:
 $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$
 [Atomic weight of : C=12, H=1, O=16]. 7 4 3 2
- c) Explain the synthesis of carbon nanotubes by arc discharge method. Mention their applications. 6 2 3 2

Unit - IV

- 07** a) Explain the health effects caused by the following metals present in the E-waste.
 i. Lead ii. Cadmium and iii. Arsenic 7 2 4 1
- b) What is cathodic protection? Explain the impressed voltage method given to metals exposed to corrosion environment. 7 2 4 1
- c) Explain the effect of the following factors on the rate of metallic corrosion:
 i. Nature of corrosion product ii. Temperature 6 2 4 1

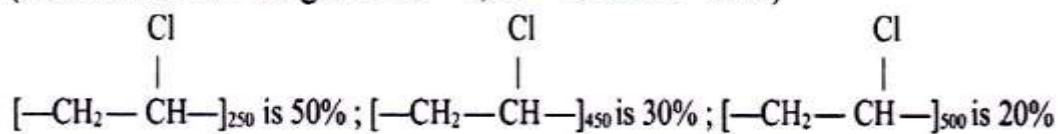
OR

- 08** a) Explain electrochemical theory of corrosion taking iron as an example. 7 2 4 1
- b) Discuss differential metal and differential aeration corrosion. 7 2 4 1
- c) Explain the hydrometallurgical process of recovery of gold from E-waste. 6 2 4 1

Unit - V

- 09** a) Evaluate the number average and weight average molecular masses of a polymer with the following composition.

(Given: Atomic weight of H = 1, C = 12 & Cl = 35.5)



- b) Explain the mechanism of conduction in polyacetylene by oxidative doping. 7 5 5 2
- c) Distinguish between thermotropic and lyotropic liquid crystals. 7 2 5 2
- 6 2 5 2

OR

- 10** a) Discuss the working principle of light emitting diodes and give two applications. 7 2 5 2
- b) Show the mechanism of conduction in polyacetylene by reductive doping. 7 3 5 2
- c) What is a director in a liquid crystal terminology? Explain the molecular ordering in case of solids; liquids and liquid crystals. 6 2 5 2