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21CHE12

First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What are Reference Electrodes? Explain the construction and working of Calomel Electrode. (07 Marks)
b. Define Single Electrode Potential. Derive Nernst equation for Single Electrode Potential. (07 Marks)
c. Explain the construction and working of Li – ion battery. Mention its applications. (06 Marks)

OR

- 2 a. Explain Primary, Secondary and Reserve batteries with an example. (06 Marks)
b. Explain the experimental determination of pH by using glass electrode. (07 Marks)
c. A cell consists of Copper rod dipped in 5M CuSO₄ solution and Iron rod dipped in 0.05 M FeSO₄ solution. Given $E_{Cu}^0 = +0.34V$ and $E_{Fe}^0 = -0.44V$. Write Cell representation, Cell reactions and calculate Emf of the cell. (07 Marks)

Module-2

- 3 a. Define Corrosion. Describe Electrochemical theory of corrosion by taking Iron as an example. (07 Marks)
b. What is Cathodic Protection? Explain Sacrificial Anodic method and Impressed Current method of Cathodic protection. (07 Marks)
c. What is Metal Finishing? Mention technological importance of Metal Finishing. (06 Marks)

OR

- 4 a. Explain the factors affecting the corrosion rate :
i) Ratio of anodic to cathodic areas.
ii) Nature of the corrosion product.
iii) pH. (06 Marks)
b. What is Corrosion Penetration Rate? A piece of corroded plate was found in the submerged ocean vessel. It was estimated that the original area of the plate was 10 inch² and that approximately 2.6kg had corroded away during the submersion for a period of 10 years. Calculate Corrosion Penetration Rate (CPR) in terms of mpy and mmy. Given density (ρ) of iron = 7.9 g/dm³
mpy $\rightarrow k = 534$
mmy $\rightarrow k = 87.6$. (07 Marks)
c. What is Electroless Plating? Write the differences between Electroplating and Electroless plating. (07 Marks)

Module-3

- 5 a. What are Conducting Polymers? Explain the mechanism of conduction in Polyaniline. (07 Marks)
b. Explain the synthesis, properties and applications of Poly Lactic Acid. (06 Marks)
c. What are Nanomaterials? Explain the synthesis of Nanomaterials by Sol – gel process. (07 Marks)

OR

- 6 a. What are Polymer Composites? Explain the synthesis and applications of Kevlar fibre. (07 Marks)
- b. Explain any two size dependent properties of Nanomaterials. (06 Marks)
- c. Write a note on Fullerene and mention its applications. (07 Marks)

Module-4

- 7 a. What is Green Chemistry? Explain briefly any six basic principles of Green Chemistry. (07 Marks)
- b. Describe the production of hydrogen by Photocatalytic Water Splitting Method. (06 Marks)
- c. Explain the synthesis of Paracetamol by Conventional and Green Route Method. (07 Marks)

OR

- 8 a. Explain the impacts of Oxides of Nitrogen (NO_x) and Oxides of Sulfur (SO_x) on the Environment. (06 Marks)
- b. Explain the working of Photovoltaic cell, with a neat diagram. (07 Marks)
- c. Describe working of Methyl alcohol – Oxygen fuel cell [$\text{CH}_3\text{OH} - \text{O}_2$] with a neat diagram. Mention its applications. (07 Marks)

Module-5

- 9 a. Explain Theory, Instrumentation and Applications of Colorimeter. (07 Marks)
- b. Explain the principle of Volumetric analysis and requirement of Volumetric analysis. (06 Marks)
- c. Define Biological Oxygen demand and Chemical Oxygen demand. 25 ml of waste water required 18.0ml and 25.2ml of 0.1N FAS solution for sample and blank titration respectively. Calculate COD of the waste water sample. (07 Marks)

OR

- 10 a. Explain applications of Conductometry :
i) Strong acid Vs Strong base ii) Weak acid Vs Strong base. (07 Marks)
- b. Define the following units of Standard Solution :
i) Normality ii) Molarity iii) PPM. (06 Marks)
- c. 25ml³ of hard water sample titrated against 0.01M EDTA solutions consumed 18.0 cm³ of EDTA solution. 25cm³ same sample of hard water was boiled, filtered and titrated against 0.01M EDTA solution consumed 12.0 cm³ EDTA solution. Calculate Total, Permanent and Temporary hardness of the water sample. (07 Marks)

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