

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2024 Semester End Main Examinations

Programme: B.E

Branch: Common to all Branches

Course Code: 21CY1BSECT / 21CY2BSECT

Course: Engineering Chemistry

Semester: I / II

Duration: 3 hrs.

Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

- 1 a) What are ion-selective electrodes? Describe the construction and application of glass electrode in the determination of pH of a solution. **7**
- b) What are concentration cells? EMF of the concentration cell: $\text{Cu}|\text{CuSO}_4 (0.01 \text{ M})||\text{CuSO}_4 (X \text{ M})|\text{Cu}$, at 29°C is 0.015V . Find the concentration of CuSO_4 at the cathode and write cell reactions. **6**
- c) Justify the following statements: (i) The potential of the calomel electrode increase with decrease in KCl concentration (ii) Anodizing is a surface conversion coating. **4**
- d) Chromium anodes are not used in electroplating of chromium: Appraise the statement. **3**

OR

- 2 a) Corrosion is an electrochemical phenomenon: Justify the statement by taking corrosion of iron as a model. **6**
- b) Predict the effect of the following factors on the rate of corrosion: (i) Temperature (ii) Hydrogen overvoltage **4**
- c) Describe the type of corrosion protection method used when a buried pipeline is attached with a Mg block. **4**
- d) Explain the electroless plating of copper with relevant reactions and mention its advantages over electroplating. **6**

UNIT - II

- 3 a) Define GCV. When 0.96 g of a chemical fuel subjected to complete combustion in a Bomb calorimeter, the temperature of the surrounding water increased from 24.7°C to 26.5°C . The weight of water taken and water equivalent of bomb calorimeter were 1.5 Kg and 0.45 Kg respectively. Calculate GCV and NCV of the fuel. (Given: Specific heat of water = $4.186 \text{ KJ/Kg/}^\circ\text{C}$, Latent heat of steam is 2457 KJ/Kg , and % of Hydrogen is 5%). **6**
- b) Justify the statement: Reformation of petrol increases the octane number. Explain reformation of petrol with any two relevant chemical reactions. **5**
- c) Explain the construction and working of the Ni-MH battery. **5**

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

- d) Justify the following statements: (i) KOH cannot be used as an electrolyte in methanol-oxygen fuel cells. (ii) Water cannot be used as a solvent in lithium batteries. 4

UNIT - III

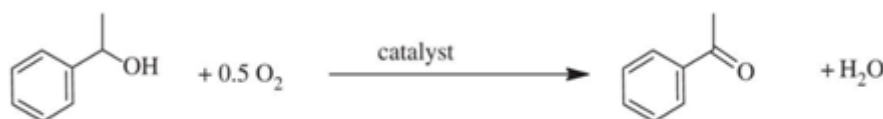
- 4 a) A polymer sample has following composition, 100 molecules have molecular mass 10000 g/mol, 200 molecules have molecular mass 20000g/mol and 500 molecules have molecular mass 50000 g/mol. Calculate the number average, weight average molecular mass and PDI of the polymer. 5
- b) Write synthesis of (i) PMMA (ii) Butyl rubber. Mention their applications. 6
- c) What are polymer composites? Describe the synthesis and applications of Kevlar fiber. 5
- d) Explain any two factors affecting Tg. 4

UNIT - IV

- 5 a) Discuss the synthesis of adipic acid by green and conventional routes. 6
- b) In an experiment, 25 cm³ of hard water sample required 15.7 cm³ 0.018 M EDTA solution for titration using EBT as an indicator. Under similar conditions, another 25cm³ of the same hard water sample after boiling and cooling required 12.3 cm³ of EDTA solution. Calculate the temporary, permanent and total hardness of water sample. 5
- c) What is desalination of water? Explain the process of desalination of water by reverse osmosis with a neat diagram. 5
- d) Justify the roles of Ag₂SO₄ and HgSO₄ in experimental determination of COD of waste water. 4

OR

- 6 a) Elaborate on the secondary treatment of sewage water by trickling filter method. 6
- b) Which of the reactions has the greater atom economy (Atomic mass : C=12, H=1, O= 16, Cr= 52, S = 32) 6



- c) Elaborate on any four principles of green chemistry. 4
- d) Justify the role of : i) buffer in EDTA titration ii) functional groups present on ion exchange resin 4

UNIT - V

- 7 a) Explain the phase diagram of water system. Explain the significance of the areas, curves, and triple point. 8
- b) How nanomaterials are synthesized by sol-gel method? 6
- c) Explain the process of estimation of sodium by flame photometry. Why flame photometry cannot be used for transition metals estimation? 6
