

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

Autonomous Institute Affiliated to VTU

## May 2023 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**

**Date: 18.05.2023**

**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) Explain the construction and working of glass electrode. Derive an expression for potential of glass electrode. 5
- b) What are concentration cells? Calculate the cell potential of the following cell at 290 K :  $\text{Ag}|\text{Ag}^+(0.024\text{M})||\text{Ag}^+(0.056\text{M})|\text{Ag}$  5
- c) Justify : 4
  - i. EMF of the calomel electrode is dependent on the concentration of KCl at STP.
  - ii. Chromium anodes are not used in electroplating of chromium.
- d) With appropriate reactions, explain pitting corrosion with suitable example. Justify that in pitting corrosion, rate of corrosion is progressively increasing. 6

### OR

- 2 a) Describe the construction and working of calomel electrode. 5
- b) Write cell reactions and calculate the emf of the cell at 298 K, consisting of Zn metal in contact with  $\text{ZnSO}_4$  solution (0.001M) and Ag metal in contact with  $\text{AgNO}_3$  solution (0.1 M). The SRP values of  $\text{Ag}^+/\text{Ag}$  half-cell is +0.80 V and  $\text{Zn}^{2+}/\text{Zn}$  is -0.76 V 5
- c) Explain electroless plating of copper for the manufacturing of PCB in electronic industry. 4
- d) How the following factors affect the rate of corrosion? i) Ratio of anodic to cathodic area, (ii) Polarization 6

### UNIT - II

- 3 a) In a bomb calorimeter experiment, 1.05 g of a solid fuel was subjected to complete combustion. The temperature of surrounding water (1.3 kg) is increased by 3.1 °C, if the water equivalent of calorimeter is 0.5 kg, find out GCV and NCV of the fuel. (Given: Molecular formula of fuel:  $\text{C}_7\text{H}_6\text{O}_2$ , Specific heat of water: 4.187 KJ/Kg/ °C, Latent heat of steam: 587 x 4.187 KJ/Kg) 5
- b) Explain the construction and working of a silicon based solar cell. 5
- c) What is petroleum cracking? Justify the need for cracking. 4
- d) What are secondary batteries? Explain the construction and charge-discharge reactions of Li-CoO<sub>2</sub> battery. 6

**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.

### UNIT - III

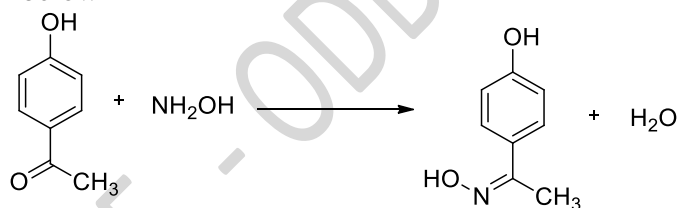
- 4 a) Describe the synthesis of PMMA. Mention its applications. 5  
b) Define glass transition temperature (T<sub>g</sub>). Elaborate on any two factors affecting T<sub>g</sub>. 6  
c) Discuss the structure, properties, and applications of Kevlar fibre. 5  
d) A polymer sample has following composition: 100 molecules with molecular weight 25000, 200 molecules with molecular weight 27000, and another 100 molecules with molecular weight 30000. Calculate number and weight average molecular weights. 4

### UNIT - IV

- 5 a) Elaborate on any five principles of green chemistry. 5  
b) Discuss the synthesis of methyl methacrylate by green route. 4  
c) With a neat sketch, discuss the ion exchange process of water purification. Why regeneration of spent resin is required in ion exchange process? 6  
d) Define COD. In a COD experiment, 10 mL of waste water sample required 12 mL and 8.5 mL of 0.025 N FAS solution for blank and back titrations, respectively. Calculate the COD of the given sample. 5

### OR

- 6 a) Elaborate on synthesis of adipic acid by conventional and green route. What are the advantages in green route? 7  
b) The synthesis of key intermediate required for the synthesis of paracetamol is given below 4



Calculate atom economy for the same.

(Given: Atomic weights of H : 1, C : 12, N : 14, O : 16)

- c) Justify the need of aerobic condition in secondary treatment of sewage water. 3  
d) Explain the estimation of total hardness of water by EDTA titration. 6

### UNIT - V

- 7 a) What are carbon nanotubes? How are they classified? Elaborate their properties and applications. 6  
b) Explain the principles behind estimation of copper by colorimetry. 5  
c) State and explain the Gibbs phase rule. 3  
d) What is eutectic point? Sketch labelled lead-silver phase diagram. 6

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