

Reg No : Name :

**MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM**

(Govt. Aided Autonomous Institution)

Second Semester B.Tech. Degree Examination, May, 2026

Course Code: B24CY1T01B

Course Name: Engineering Chemistry (B)

(For CE Branch)

Max. Marks: 100

Duration: 3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)**Answer all questions**

1. What is agglomeration? Give one example each for reducing agent and capping agent used to prevent agglomeration.
2. Why does graphene exhibit exceptional strength?
3. Why electronic spectrum appears to be broad?
4. Why is the sample placed in a vacuum chamber during SEM measurements?
5. Calculate the potential of Zinc electrode at 25⁰C when 2M ZnSO₄ solution is used. Given $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$.
6. Justify the need for anodizing aluminium.
7. What are the advantages of using ultrafiltration in water treatment?
8. Define reverse osmosis. What are the main types of membranes used in reverse osmosis systems?
9. List any three applications of Glass Reinforced Plastics.
10. Mention any three applications of ceramics.

PART - B: 70 Marks (5 Qns x 14 Marks)**Answer any One full question from each module.****Module 1**

11. a. Describe how nanomaterials are classified based on their structural composition with (8 Marks) examples. Explain any two properties of nanomaterials.
b. Explain any three important applications of nanomaterials. (6 Marks)

OR

12. a. What is top-down approach for the synthesis of nanomaterials? Explain the process involved in mechanical milling. (8 Marks)
- b. Discuss the process involved in laser ablation for the synthesis of nanomaterials. What are the factors in the method that affect the properties of nanomaterials? (6 Marks)

Module 2

13. a. What is the principle of IR spectroscopy? List the important applications of IR spectroscopy and explain how inter and intra molecular H-bonding can be distinguished using IR spectroscopy. (8 Marks)
- b. How many vibrational modes are possible for HCN, HCl and CO₂? Draw the vibrational modes of CO₂ and explain why symmetric stretching is not IR active. (6 Marks)

OR

14. a. What is spectroscopy? Discuss the classification based on the nature of interaction and interacting species. Provide one example for each type. (8 Marks)
- b. Define Beer Lambert's law. A solution of a compound has an absorbance of 0.75 when measured at a wavelength 550 nm. Calculate the concentration of the solution, when the molar absorptivity is 500 mol⁻¹Lcm⁻¹ and the path length is 3 cm. (6 Marks)

Module 3

15. a. Discuss the role of galvanic series in understanding corrosion. Compare it with electrochemical series (ECS) and infer on why the order of Zn and Al is reversed in galvanic series. (8 Marks)
- b. Compare galvanic and pitting corrosion. (6 Marks)

OR

16. a. What are the applications of Nernst equation? Determine the E°_{cell} and concentration of Cd²⁺ ions in the following electrochemical cell, Fe/Fe²⁺(0.1 M) // Cd²⁺(x M) / Cd. Write the cell reactions. Given E_{cell} = - 0.02 V, E⁰_{Fe²⁺/Fe} = - 0.44V and E⁰_{Cd²⁺/Cd} = - 0.40 V at 25°C. (8 Marks)
- b. Discuss the electroless plating of copper as a corrosion prevention method. (6 Marks)

Module 4

17. a. Explain the principle and functioning of the zeolite process for water softening. How zeolites are regenerated? Discuss the advantages of zeolite process. (8 Marks)
- b. What are ion exchange resins and how are they classified? Provide examples and explain the regeneration process of ion exchange resins. (6 Marks)

OR

18. a. Explain the concept and disadvantages of hardness in water. Discuss the differences (8 Marks) between temporary and permanent hardness and explain how temporary hardness is removed.
- b. A sample of water on analysis has been found to contain the following in ppm: Ca (6 Marks) $(\text{HCO}_3)_2 = 10.5$ ppm, Mg $(\text{HCO}_3)_2 = 12.5$ ppm, $\text{CaSO}_4 = 7.5$ ppm, $\text{CaCl}_2 = 8.2$ ppm and $\text{MgSO}_4 = 2.6$ ppm. Calculate the temporary and permanent hardness of the water sample in ppm. (Given atomic weights of H = 1, C = 12, Ca = 40, Mg = 24, S = 32, O = 16, Cl = 35.5).

Module 5

19. a. Discuss the preparation, properties and applications of Poly Lactic Acid. (8 Marks)
- b. Explain the preparation and applications of PMMA. (6 Marks)

OR

20. a. What are SBR and Kevlar? What are important properties of SBR and Kevlar? (8 Marks)
- b. How does UPVC differ from PVC. Discuss the preparation and applications of UPVC. (6 Marks)
