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Question Paper Code: U1Y04

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

First Semester

Mechanical Engineering

21UCY104 - ENGINEERING CHEMISTRY

(Common to Chemical Engineering)

(Regulation 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- Which one of the following pair of atoms most likely to form an ionic bond? CO1- U
(a) Na & F (b) C&C (c) N &F (d) F& F
- Which among the following is weakest bond? CO1- U
(a) Covalent bond (b) Ionic bond (c) Metallic bond (d) Hydrogen bond
- The electronic configuration of an atom with atomic number 8 is CO1- U
(a) $1s^2 2s^2 2p^3 3s^1$ (b) $1s^2 2s^2 2p^1 3s^2 3p^1$ (c) $1s^2 2s^1 2p^6 3s^1$ (d) $1s^2 2s^2 2p^4$
- The unit of rate constant for a second order reaction is CO2- U
(a) mol / S (b) mol / l² / S (c) mol / l / S (d) lit / mole / S
- What type of reaction takes place when an acid dissolves in water? CO2- U
(a) Exothermic (b) Endothermic (c) Substitution (d) Displacement Reaction
- Temporary Hardness of water can be removed by CO3- U
(a) Boiling (b) Sedimentation (c) Solvent Extraction (d) Filtration
- Hardness in water expressed in terms of equivalent of CO3- U
(a) CaCl₂ (b) MgCl₂ (c) CaCO₃ (d) MgCO₃
- During the galvanic corrosion the noble metal act as CO4- U
(a) Anode (b) Cathode (c) Catalyst (d) Corroding metal

9. Iron corrodes faster in CO4- U
 (a) Hard water (b) Soft water (c) Demineralized water (d) Distilled water
10. In electro plating the article to be plated is subjected to pickling, this is to CO4- U
 (a) Remove grease (b) Increase the rate of plating
 (c) Remove the oxide scale (d) Get a bright deposit

PART – B (5 x 2= 10Marks)

11. State Paulis exclusion principle CO1-U
12. Define Order of reaction CO2-U
13. Calgon conditioning is better than phosphate conditioning - Justify CO3- Ana
14. List out the salts responsible for the hardness of water CO3-U
15. Define Dry corrosion CO4-U

PART – C (5 x 16= 80Marks)

16. (a) (i) Describe the characteristic properties of covalent compounds. CO1-U (8)
 (ii) Discuss hydrogen bonding with its consequences. CO1-U (8)
- Or
- (b) (i) Write the basic postulates and limitations of valance bond CO1-U (8)
 theory.
- (ii) Explain the hybridization involved and predict the shape for CO1-U (8)
 the following molecule
- (a) CH₄
- (b) C₂H₄
17. (a) (i)Derive the integrated rate equation for a second order reaction CO2-U (8)
 where the reactants are same concentration.
- (ii) Write a notes on Redox reaction with an example. CO2-U (8)
- Or
- (b) (i)Deduce the expression for the rate constant of first order CO2-U (8)
 reaction.
- (ii) Define the term rate of reaction, Discuss various factors that CO2-U (8)
 affect the rate of reaction.

18. (a) How is hardness of water determined by the complexometric method? Write the necessary calculation CO3-U (16)
- Or
- (b) (i) Explain the process of scale and sludge formation in boilers. CO3-U (8)
- (ii) With the help of a neat diagram, explain the reverse osmosis method for desalination of brackish water CO3-U (8)
19. (a) (i) Calculate the temporary, permanent and total hardness of a sample water containing $\text{Mg}(\text{HCO}_3)_2 = 73 \text{ mg/lit}$, $\text{Ca}(\text{HCO}_3)_2 = 162 \text{ mg/lit}$, $\text{MgCl}_2 = 95 \text{ mg/lit}$, $\text{CaSO}_4 = 136 \text{ mg/lit}$, Atomic weight: Ca = 40, Mg = 24, C = 12, S = 32, O = 16, H = 1, Cl = 35.5. CO3-U (8)
- (ii) Describe the demineralization of water by an ion exchange process in detail. CO3-U (8)
- Or
- (b) Give Principal of Zeolite process ? Write advantages , disadvantages, and limitation of Zeolite process. CO3-U (16)
20. (a) (i) Explain the rusting of iron on the basis of electrochemical theory of corrosion CO4-U (8)
- (ii) Briefly describe various components of paint and their functions. CO4-U (8)
- Or
- (b) (i) Write a short notes on CO4-U (8)
- (a) Concentration cell corrosion
- (b) Wire fence corrosion
- (ii) Discuss the mechanism of dry corrosion CO4-U (8)

