

Question Paper Code : 10283

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Second Semester

Common to all branches (Except Marine Engineering)

CY 2161/183202/CY 24/080010002 — ENGINEERING CHEMISTRY — II

(Regulation 2008)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Construct a cell with Fe and Mg at standard conditions and calculate the Emf developed. Given : $E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.44 \text{ V}$ and $E^\circ(\text{Mg}^{2+}/\text{Mg}) = -2.37 \text{ V}$.
2. Zinc reacts with dilute H_2SO_4 to give hydrogen but Ag does not - Explain.
3. Mention the types of corrosion.
4. What are organic inhibitors? What will be the reason for the increase in inhibiting power of aliphatic amines in the following given order?
 $\text{NH}_3 < \text{RNH}_2 < \text{R}_2\text{NH} < \text{R}_3\text{N}$.
5. The ultimate analysis of a coal sample indicates Carbon = 84%, Sulphur = 1.5%, Nitrogen = 0.6%, Hydrogen = 5.5% and Oxygen = 8.4%. Calculate the GCV.
6. Write the expression for the amount of air required for combustion of 1 kg fuel.
7. $\text{NH}_4\text{Cl}(\text{s}) \rightleftharpoons \text{NH}_3(\text{g}) + \text{HCl}(\text{g})$. How many phases, components and degrees of freedom are available in this equilibrium?
8. Write the chemical compositions of Dutch metal and Gun metal.
9. Mention any two applications of UV spectroscopy.
10. State the principle involved in colorimetric analysis.

PART B — (5 × 16 = 80 marks)

11. (a) (i) What is an ion selective electrode? Explain its principle and working. (6)
- (ii) Derive an expression for Nernst equation. The emf of a cell measured by means of a hydrogen electrode against a saturated calomel electrode at 298 K is 0.4188 V. If the pressure of the H₂ (g) was maintained at 1 atm, calculate the pH of the unknown solution, given the potential of reference calomel electrode is 0.2415 V. (10)

Or

- (b) (i) Draw the conductometric titration curve of strong acid versus strong base and explain it. (4)
- (ii) Explain with suitable examples any two applications of emf series. (4)
- (iii) Explain the potentiometric titration of FeSO₄, vs. K₂Cr₂O₇ with a neat diagram. (8)
12. (a) (i) State the differences between chemical corrosion and electrochemical corrosion. (6)
- (ii) Write a detailed note on cathodic protection methods. (10)

Or

- (b) (i) Discuss the various steps involved in electroless nickel plating. (8)
- (ii) Explain the different types of inhibitors used to control the corrosion rate. (8)
13. (a) (i) How is metallurgical coke manufactured by Otto Hoffmann's method? What are the important by products recovered from coke oven gas? (8)
- (ii) Describe the significance of ultimate analysis of coal. (4)
- (iii) List the fractions of hydrocarbons collected between boiling range of 30°C – 400°C by fractional distillation of crude oil. (4)

Or

- (b) (i) What is hydrogenation of coal? Write the Fischer-Tropsch process of manufacture of liquid fuels from solid fuels. (8)
- (ii) Write in detail chemical reactions involved in the manufacture of producer gas and mention its chemical composition. (8)

14. (a) (i) State phase rule and explain the terms involved. (8)
(ii) Draw and explain the phase diagram of two component system with an example. (8)

Or

- (b) (i) Write short notes on any four methods of heat treatment of steel. (8)
(ii) Give the composition and uses of the following alloys
(1) Nichrome
(2) Stainless steel
(3) Brass
(4) Bronze. (8)
15. (a) (i) Write the principle of UV spectroscopy. (6)
(ii) Write the mechanism of interaction between the vibrating molecule and infra-red radiation. (6)
(iii) A solution of thickness 2 cm. transmitted 40% incident light. Calculate the concentration of this solution, given that the molar absorptivity is $6000 \text{ dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$. (4)

Or

- (b) (i) Explain briefly the principle of a flame photometer. A sample solution is found to contain KCl and NaCl. How will you determine the amount of NaCl alone present in the solution using a flame photometer? (10)
(ii) Compare : Flame photometry and Atomic absorption spectroscopy. (6)