Register No.: ………………………………   Name: ………………………………………………………………..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER B.TECH DEGREE EXAMINATION (S), SEPT 2022
(2020 SCHEME)

Course Code :   **20CYT100**

Course Name: **Engineering Chemistry**

Max. Marks :   **100**   **Duration: 3 Hours**

PART A
(Answer all questions. Each question carries 3 marks)

1. Calculate the equilibrium constant for the following reaction at 25^0C;
   $Fe(s) + Cu^{2+} (aq) \longrightarrow Fe^{2+} (aq) + Cu (s)$ Given $E^0_{Fe2+/Fe}$= **-0.44 V**,
   $E^0_{Cu2+/Cu} = 0.34$ V

2. Differentiate between electrolytic cell and electrochemical cell.

3. IR spectroscopy can be used to differentiate intra molecular and inter molecular hydrogen bonds. Explain with an example.

4. State and explain Beer-Lambert's law. Give any one limitation of this law.

5. TGA will not give information regarding phase changes. Give reason.

6. Explain the hydrolysis method for preparing nanomaterials.

7. Distinguish between enantiomers and diastereomers.

8. Write the synthesis of ABS rubber.

9. A sample of water on analysis gives the following results. $[Ca^{2+}]$ = 200 mg/L, $[Mg^{2+}]$ = 180 mg/L, $[HCO_3^-]$= 360 mg/L, $[Cl^-]$= 200 mg/L and $[Na^+]$ = 80 mg/L. Calculate temporary and permanent hardness.

10. Why hardness of water is expressed in terms of $CaCO_3$ equivalents?

PART B
(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Derive a quantitative relationship between electrode potential and concentration of the electrolyte.   (8)

    b) How is electroless nickel plating done? Write the reactions involved. Give any two applications of it.   (6)

OR

12. a) What is the principle in potentiometric titration? Explain the end point determination of a redox reaction by potentiometric titration.   (7)

    b) Describe the methods of cathodic protection.   (7)

MODULE II

13. a) Sketch the various modes of vibration possible for CO_2 and H_2O and state which of these modes are IR active. Write reason for their IR activity. (8)

    b) Explain the principle involved in MRI. Mention its applications and its advantages over conventional scanning techniques. (6)

OR

14. a) How can you differentiate NMR spectrum of CH_3CH_2Cl and CH_3CHCl_2 using the concept of spin-spin splitting? (8)

    b) CO molecule absorbs at an IR stretching frequency of $2140 cm^{-1}$. Calculate the force constant of the molecule if the atomic masses of C and O are 12u and 16u respectively. Given that $1u = 1.67 \times 10^{-27} Kg$. (6)

MODULE III

15. a) Discuss the principle and procedure in column chromatography. Explain how TLC is useful in checking the purity of each fraction. (10)

    b) Sketch the TGA graph of Calcium oxalate monohydrate giving the relevant equations. (4)

OR

16. a) Describe the principle, instrumentation, procedure and applications of GC. (10)
    b) Write any four applications of nanomaterials. (4)

MODULE IV

17. a) What is conformational isomerism? Explain the conformational isomerism in n-butane. (8)

    b) How is polyaniline synthesised? Mention two properties and two applications of polyaniline. (6)

OR

18. a) What is meant by structural isomerism? What are the different types of structural isomerism in organic molecules? Explain with examples. (8)

    b) What are OLEDs? Give the construction and working. (6)

MODULE V

19. a) Explain the method for the estimation of total hardness of water using EDTA. Write the necessary calculation steps. (10)

    b) Discuss the procedure for the determination of dissolved oxygen (DO) in water. (4)

OR

20. a) Explain aerobic and anaerobic methods for the treatment of waste water. (10)
    b) Explain the principle of reverse osmosis with the help of a neat diagram. (4)

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