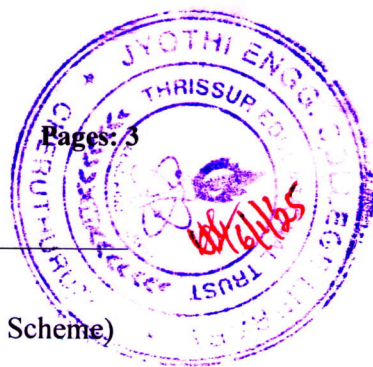


B

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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (S, FE) S2 (S, FE) Examination December 2024 (2019 Scheme)

Course Code: CYT 100

Course Name: ENGINEERING CHEMISTRY

(2019 -Scheme)

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks*

- |    |  | Marks |
|----|--|-------|
| 1  | How is single electrode potential developed?   | (3)   |
| 2  | There are automatic built-in circuit breakers in Li ion battery. Explain.  | (3)   |
| 3  | State Beer Lambert's law and write the expression for absorbance.  | (3)   |
| 4  | Which of the following nuclei are NMR active – $^{12}\text{C}$ , $^1\text{H}$ , and $^{13}\text{C}$ . Why?         | (3)   |
| 5  | Give any three differences between thermogravimetric analysis (TGA) and differential thermal analysis (DTA).       | (3)   |
| 6  | How are nanomaterials classified based on dimensions?  | (3)   |
| 7  | Draw the chair and boat conformations of cyclohexane. Why boat form is less stable than chair form?                | (3)   |
| 8  | What is optical activity? Draw the optical isomers of lactic acid $[\text{CH}_3\text{CH}(\text{OH})\text{COOH}]$ . | (3)   |
| 9  | Which is the standard for expressing the hardness of water. Why is it selected as the standard?                    | (3)   |
| 10 | List out any three advantages of ion exchange process.   | (3)   |

**PART B**

*Answer one full question from each module, each question carries 14 marks.*

**MODULE 1**

- 11 (a) Derive Nernst equation for electrode potential. Calculate the EMF of a Daniel cell when the concentration of  $\text{Zn}^{2+}$  ion is 0.02M and that of  $\text{Cu}^{2+}$  ion is 0.2M. Given  $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$  and  $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$ . (8)
- (b) Explain electroless nickel plating. List out any two applications of electroless nickel plating. (6)
- 12 (a) Give the principle of glass electrode. Explain the determination of pH using glass electrode? (8)

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- (b) Explain hydrogen evolution corrosion in acid and alkaline media with examples. (6)

**MODULE 2**

- 13 (a) Explain the different types of electronic transitions in UV spectroscopy. Draw the molecular energy level diagrams of 1,3-butadiene and benzene showing the electronic transitions. (8)
- (b) What is chemical shift in NMR spectroscopy? Name the reference compound used in measuring the chemical shift of signals in  $^1\text{H}$  NMR spectra of molecules and why is it selected as the reference? (6)
- 14 (a) Show that the frequency of absorbed infrared radiation ( $\nu$ ) is equal to the fundamental vibrational frequency ( $\nu_0$ ) of a diatomic molecule. CO molecule shows IR absorption at  $2137\text{cm}^{-1}$ . Calculate the force constant of the CO bond, if the atomic masses of C=12amu and of O = 16amu.  $1\text{amu} = 1.67 \times 10^{-27}\text{kg}$  (8)
- (b) Draw the structure of the following molecules which give only one signal in the  $^1\text{H}$  NMR spectra (i)  $\text{C}_2\text{H}_6\text{O}$  (ii)  $\text{C}_8\text{H}_{18}$  and (iii)  $\text{C}_4\text{H}_6$ . (6)

**MODULE 3**

- 15 (a) Explain the principle, instrumentation and procedure employed in High Performance Liquid Chromatography (HPLC)? (10)
- (b) TGA can be employed in the determination of stability of polymers. Substantiate the statement with examples. (4)
- 16 (a) Explain the principle, instrumentation and any two applications of differential thermal analysis (DTA) and draw the DTA of calcium oxalate monohydrate in a current of air. (10)
- (b) Explain the synthesis of aluminium oxide nanoparticles by sol gel method. (4)

**MODULE 4**

- 17 (a) What are conducting polymers? Draw the structure of polyacetylene and polyaniline. Explain different types of doping in conducting polymers with examples. (8)
- (b) Draw the energy profile of various conformations of butane and comment on the stabilities of these conformations. (6)
- 18 (a) Draw the structures of geometrical isomers of 1,2-dimethylcyclohexane and their chair conformations. Explain the stability of each conformation. (10)
- (b) How is Kevlar synthesised? Explain the reason for its strength. (4)



MODULE 5

- 19 (a) Explain the principle and procedure used in the estimation of hardness of water in EDTA method. (10)
- (b) Calculate the temporary and permanent hardness of water containing 240ppm  $\text{Ca}^{2+}$ , 72ppm  $\text{Mg}^{2+}$ , 732ppm  $\text{HCO}_3^-$ , 126ppm  $\text{Cl}^-$ , 72ppm  $\text{SO}_4^{2-}$ , 124ppm  $\text{Na}^+$ . (4)
- 20 (a) Explain the various steps involved in Municipal water treatment. (10)
- (b) Determine the maximum BOD of water sample containing 70mg of carbohydrate ( $\text{CH}_2\text{O}$ ) per litre. (4)

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