

MODULE 2

- 13 a) Discuss the principle, instrumentation and applications of UV-visible spectroscopy. (8)
- b) What are the criteria for a molecule to absorb IR radiation? Which of the following molecules are IR active? Give reason. (i) HF, (ii) Cl₂, (iii) CO, (iv) O₂. (6)
- 14 a) Write the principle of IR spectroscopy. Explain the different modes of vibrations possible for CO₂ and H₂O and identify IR active vibrations. (10)
- b) An organic compound with molecular formula C₃H₅Cl₃ gave the following ¹H NMR data, a singlet with a chemical shift of 2.20 ppm and another singlet with a chemical shift of 4.02 ppm. Assign a structural formula. (4)

MODULE 3

- 15 a) Discuss the following methods for nanoparticle synthesis (i) Hydrothermal, (ii) sol-gel, (iii) chemical reduction and (iv) electro reduction. (10)
- b) Discuss the different types of detectors used in HPLC. (4)
- 16 a) Explain the principle, instrumentation and working of scanning electron microscope. (8)
- b) Explain the three major steps in the working procedure of thin layer chromatography technique. (6)

MODULE 4

- 17 a) Explain the electrochemical and chemical methods for the synthesis of polyaniline. List any two applications and properties. (8)
- b) Write the Fischer projection formula for lactic acid (CH₃-CH(OH)-COOH). Draw the mirror image and assign *R-S* notation for the compound as well as its mirror image. Give the rules for assigning *R-S* notation. (6)
- 18 a) Draw and explain the conformational isomerism in (*cis*) and (*trans*) 1,4-dimethyl cyclohexane. Which conformer is more stable in each case and why? (8)
- b) Explain copolymerization with one example. How copolymers are classified? (6)

MODULE 5

- 19 a) Describe the ion-exchange method for the demineralisation of water. (8)
- b) A water sample found to contain 16.2 mg/L calcium bicarbonate, 29.2 mg/L magnesium bicarbonate, 19.0 mg/L magnesium chloride and 27.2 mg/L calcium sulphate. Calculate the temporary and permanent hardness. What happens to the hardness of water sample if Na₂CO₃ is added? (6)

- 20 a) What do you mean by dissolved oxygen? Mention the significance and explain the Winkler's method for the estimation of dissolved oxygen. (10)
- b) Find the BOD if 250 mL sewage water was diluted to 2000 mL using dilution water. The initial DO and DO level after 5 days were found to be 7.9 ppm and 4.4 ppm respectively. (4)
