

Question 1 Write the following

- (i) Describe in detail the phases of the analytical process in laboratory automation and the technologies used in specimen identification and delivery. (7 Marks)
- (ii) Define and explain the Henderson–Hasselbalch equation. Derive the equation and discuss its importance in buffer preparation and biological systems. (7 Marks)

OR

- (i) Explain the types of emission spectra and differentiate between continuous, line, and band spectra with examples. (7 Marks)
- (ii) Discuss the dissociation of amino acids, the concept of zwitterion, and the method to calculate the isoelectric point (pI). (7 Marks)

Question 2 Write the following

- (i) Describe the principle of partition chromatography and explain how it differs from adsorption chromatography. (7 Marks)
- (ii) Discuss the differences between analytical and preparative ultracentrifugation and their respective uses. (7 Marks)

OR

- (i) Describe the steps involved in performing an UPLC analysis, including sample application, development, and detection. (7 Marks)
- (ii) Explain the working principle of Gas Liquid Chromatography and the roles of the stationary and mobile phases. (7 Marks)

Question 3 Write the following

- (i) Detail the steps of the Southern blotting technique from genomic DNA extraction to signal detection. (7 Marks)
- (ii) Describe the Sanger chain-termination method for DNA sequencing. Include details on ddNTP incorporation, fragment separation, and data interpretation. (7 Marks)

OR

- (i) Discuss in detail the biochemical principle, protocol steps, data analysis on the SRB cytotoxicity assay. Compare the MTT and SRB cytotoxicity assays. (7 Marks)
- (ii) Explain in detail the principle and methodology of SDS-PAGE. Discuss two applications of SDS-PAGE in research or diagnostics. (7 Marks)

Question 4 Write the following

- (i) Describe the three main types of radioactive decay (α , β , γ). (7 Marks)
- (ii) Discuss on the Liquid Scintillation Counting Process. (7 Marks)

OR

- (i) Discuss on the β radioactive decay in detail. (7 Marks)
- (ii) Discuss on safety measures in handling radio-isotopes. (7 Marks)

Question 5 Attempt any seven out of twelve (14 Marks)

- (i) Define: 1 M, 1 N, and 1 m solutions.
- (ii) What is meant by transmittance and how is it related to absorbance?
- (iii) State Beer's Law and Lambert's Law separately.
- (iv) Name two types of ion exchangers.
- (v) What is the principle of size exclusion chromatography?
- (vi) How are samples applied in HPTLC?
- (vii) What two properties are used to separate proteins in 2D gel electrophoresis?
- (viii) State the steps involved in PCR technique.
- (ix) What is the principle of NGS.
- (x) Name three isotopes commonly used in biochemical research and briefly state their purpose.
- (xi) What is Autoradiography? Mention various types of Auto-radiography method.
- (xii) What is half-life of a radioactive isotope.

