

**RAMAKRISHNA MISSION VIDYAMANDIRA**  
(Residential Autonomous College affiliated to University of Calcutta)

**B.A./B.Sc. SIXTH SEMESTER EXAMINATION, MAY 2025**  
**THIRD YEAR [BATCH 2022-25]**

**MICROBIOLOGY (HONOURS)**

Date : 14/05/2025

Time : 11 am – 1 pm

**PAPER : DSE 4**

Full Marks : 50

1. Answer **any ten** questions : [10×2 ]
- a) What is meant by magnification of a microscope? Why is high pressure used in HPLC?
  - b) Mention differences between zonal centrifugation and Isopycnic centrifugation.
  - c) What is ultrafiltration? How does ultrafiltration differ from microfiltration?
  - d) Why do biomolecules require specific temperature and pH conditions for preservation after their isolation?
  - e) What does a cation exchange resin do? Why is pH important in ion exchange chromatography?
  - f) The absorbance of a sample is 1.2, the concentration is 0.01 mol/L, and the molar absorptivity is 2000 L/mol·cm. Determine the path length.
  - g) Why is carbon dioxide necessary for mammalian cell culture?
  - h) Suppose you are given a sample containing a variety of proteins out of which, you only require 1-5 kD mol. wt. range out of the whole. How will you extract the required range of proteins?
  - i) Why agarose is the preferred medium for electrophoresis?
  - j) What is the difference between sedimentation and centrifugation?
  - k) What is molar absorptivity? On what factors does it depend?
  - l) What are red shift and blue shift?
  - m) What is FRET?
  - n) What is meant by electromagnetic spectrum?
  - o) What do you mean by an NMR-inactive element? Give example.

Answer **any three** questions: [3×10]

2. a) What is the difference between a chromophore and a fluorophore?  
b) Absorbance of free nucleotide > absorbance of single stranded DNA > Absorbance of double stranded DNA. — Explain. What is the unit of molar extinction coefficient?  
c) What are extrinsic and intrinsic fluorescence? Give example.  
d) Discuss the shielding and de-shielding effects in NMR spectroscopy. [2+(2+1)+3+2]
3. a) Describe the development technique of ascending paper chromatography.  
b) What do you mean by the term wave-particle duality? Light exhibits wave-particle duality — Explain.  
c) What is  $R_f$ ? What are factors that can affect the  $R_f$  value? [3+(2+2)+(1+2)]
4. a) What are the advantages and disadvantages of using acetonitrile and methanol as mobile phase solvents?  
b) Differentiate between partition and adsorption chromatography.  
c) Define dwell volume.  
d) The transmittance of an aqueous solution of  $\text{KMnO}_4$  at a certain wavelength is 1 per cent (that is 0.01) for a  $10^{-3}$  molar solution in a 1 cm cell. What is its absorbance and the molar extinction coefficient of  $\text{KMnO}_4$ ?  
e) What is void volume and elution volume? [2+2+1+3+(1+1)]

5. a) What is a chromatogram in HPLC? How is it interpreted? Define peak height and peak area.  
b) Suppose you were to separate two compounds A and B; A is more polar compared to B. What should be the nature of the mobile phase? What should be the nature of stationary phase? Which compound will elute first according to your setup? Support your answer with valid reasons. [(1+2+2)+(1+1+1+2)]
6. a) Explain membrane fouling. Mention different types of fouling.  
b) Why is the choice of resin critical in ion exchange chromatography?  
c) What is an analyte? Mention the factors that can affect the structure and function of analyte. How can you ensure the stability of analyte's structure and function? [(1+2)+2+(1+2+2)]

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