UPES

End Sem examination, December 2024

Course: Bioanalytical Techniques **Semester : V**

Program: B.Tech. Biotechnology **Duration : 3 Hours**

Course Code: HSBT3004 **Max. Marks: 100**

Instructions:

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	Cos
Q 1	The stationary phase in gel filtration chromatography consists of: a) Porous beads b) Solid glass particles c) Charged ions d) Magnetic particles	1.5	CO1
Q 2	What is the purpose of using a rotor in a centrifuge? a) To control the temperature of the samples b) To hold and stabilize sample tubes during rotation c) To calculate sedimentation rates d) To measure the density of the samples	1.5	CO1
Q 3	In fluorescence spectroscopy, what is typically measured to quantify fluorescence? a) Absorption spectrum b) Emission intensity c) Sample viscosity d) Refractive index	1.5	CO1
Q 4	In cation exchange chromatography, the stationary phase has which type of charge? a) Positive charge b) Negative charge c) Neutral charge d) Variable charge	1.5	CO1
Q 5	In anion exchange chromatography, which molecules are retained on the column? a) Neutral molecules b) Positively charged molecules c) Negatively charged molecules d) Hydrophobic molecules	1.5	CO1
Q 6	Recall the name of any cation exchanger.	1.5	CO1

Q 7	**Define triplet state.**	**1.5**	**CO1**
Q 8	**What is the role of nitrilotriacetic acid (NTA) in Ni-NTA resin?** **a) To neutralize the charge on proteins** **b) To stabilize the nickel ion by chelating it and allowing binding to His-tagged proteins** **c) To increase the pH of the buffer** **d) To elute proteins from the resin**	**1.5**	**CO1**
Q 9	**The shift of an absorption maximum to a longer wavelength is called hypsochromic or red shift (True/False)**	**1.5**	**CO1**
Q 10	**Beer's law states that absorbance is directly proportional to the thickness of the absorbing material (True/False).**	**1.5**	**CO1**
Q 11	**The Svedberg unit (S) is used to measure:** **a) Centrifugal speed** **b) Sedimentation rate** **c) Density of a solution** **d) Centrifuge rotor radius**	**1.5**	**CO2**
Q 12	**The void volume (V_0) in gel filtration chromatography refers to:** **a) The volume of solvent outside the pores of the beads** **b) The total volume of the column** **c) The volume occupied by the gel beads** **d) The volume of solvent inside the pores of the beads**	**1.5**	**CO2**
Q 13	**Identify the type of chromatography and label A, B, and C:** 	**1.5**	**CO2**
Q 14	**Why is imidazole used to elute proteins from a Ni-NTA column?** **a) It binds to the nickel ion, competing with the histidine residues of the protein** **b) It denatures the protein, releasing it from the column** **c) It increases the temperature, which releases the protein** **d) It decreases the flow rate, aiding in protein recovery**	**1.5**	**CO2**
Q 15	**Which of the following amino acid residue is modified during ICAT analysis?** **a) Tyrosine b) Glycine c) Serine d) Cysteine**	**1.5**	**CO2**
Q 16	**One of the drawbacks of ICAT technique is:**	**1.5**	**CO2**

	a) Bias for cysteine rich proteins b) Can not be used for complex mixture c) Extremely cumbersome due to many manual steps d) Requirement of multi purification steps		
Q 17	Recall the full form of MALDI.	1.5	CO3
Q 18	Define the term fragment ion.	1.5	CO3
Q 19	In Differential Scanning Calorimetry (DSC), which of the following is typically recorded as a function of temperature? a) Pressure changes b) Volume changes c) Heat flow d) Light absorption	1.5	CO3
Q 20	What is the primary principle behind fluorescence spectroscopy? a) Absorption of light and heat emission b) Absorption of light and emission of light at a longer wavelength c) Light scattering by molecules d) Change in molecular mass upon excitation	1.5	CO3
Section B (4Qx5M=20 Marks)			
Q		5	CO
Q1	Describe the principle of gel filtration chromatography.	5	CO1
Q2	Differentiate between internal conversion (IC) and intersystem crossing (ISC)	5	CO1
Q3	Discuss about electron impact ionization (ESI).	5	CO2
Q4	Differentiate between fluorescence and phosphorescence.	5	CO3
Section C (2Qx15M=30 Marks)			
Q			CO
Q1	(a) What are "tags" in affinity chromatography. (2) How are they used to purify recombinant proteins? Explain with example of His-Tag. (c) Describe principle of Differential Scanning Calorimetry (with diagram).	2+5+7	CO3
Q2	(a) Define enthalpy and entropy of a reaction. (b) Explain the principle of SPR (with diagram). (c)What is SPR sensorgram (explain with figure)	5+5+5	CO4
Section D (2Qx10M=20 Marks)			

Q			
Q1	**(a) Describe the principle of isothermal calorimetry (with diagram) and (b) its various applications.**	**7+3**	**CO2**
Q2	**(a) Describe fluorescence energy transfer (FRET).** **(b) Discuss how FRET can be used for protein-protein or protein-RNA interactions.** **Or** **(a) Describe the principle of mass spectroscopy (with diagram). (b) Discuss the Electron spray ionization (ESI) in detail for protein identification.**	**5+5**	**CO4**