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BBT405D

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Structural Biology and Biophysical Techniques

Time: 3 hrs. Max. Marks: 100

***Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	With a neat sketch explain the geometry of dipeptide including phi (ϕ), psi (ψ), and omega (ω) angles in detail.	06	L1	CO1
	b.	Discuss the conformational forces that determine protein structures, with a special focus on hydrogen bonds, hydrophobic interactions, and Van der Waals forces.	08	L2	CO1
	c.	Outline the important aspects associated with Ramachandran plot with a neat diagram.	06	L2	CO1
		OR			
Q.2	a.	With a neat diagram, explain the structure of alpha helices and beta sheets. Highlight their differences and importance in secondary structures.	10	L2	CO1
	b.	Describe the structure and function of fibrous proteins like collagen and keratin. Include the role of disulphide bonds in keratin.	10	L1	CO1
		Module – 2			
Q.3	a.	With a neat diagram, explain the structure of nucleic acids, focusing on the base pairing (A-T, G-C and A-U) and forces stabilizing these interactions.	10	L2	CO2
	b.	Discuss the structural differences between A-DNA, B-DNA and Z-DNA. Include their stabilizing geometries.	10	L1	CO2
		OR			
Q.4	a.	Explain the tertiary structure of DNA, focusing on supercoiling. Include a discussion of hyperchromicity during the melting of the DNA double helix.	10	L2	CO2
	b.	Describe the Singer and Nicholson model of cell membranes. Highlight the structural and conformational properties that contribute to membrane function.	10	L1	CO2
		Module – 3			
Q.5	a.	Explain the principles and applications of Rayleigh scattering and ultra-centrifugation in biological studies.	10	L3	CO3
	b.	Describe the working principle of SEM and TEM. Compare their advantages and limitations in studying biological samples.	10	L2	CO3

		OR			
Q.6	**a.**	Explain the principle of fluorescence and phosphorescence. Discuss their differences and applications in biological research.	**10**	**L3**	**CO3**
	b.	Neatly outline the workflow of mass spectrometry with suitable diagram.	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the principles and applications of X-ray diffraction and neutron diffraction in structure determination.	**10**	**L1**	**CO3**
	b.	Describe the technique of ESR/EPR spectroscopy. Discuss its applications in biological systems.	**10**	**L2**	**CO3**
		OR			
Q.8	**a.**	Explain the principle and applications of UV and IR spectroscopy in analyzing biomolecules.	**10**	**L1**	**CO3**
	b.	Neatly explain the use of NMR spectroscopy in structure determination of a molecule.	**10**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Compare and contrast the working principle of Agarose gel electrophoresis and Gradient electrophoresis.	**10**	**L2**	**CO3**
	b.	Describe the working principles of capillary electrophoresis. Discuss its advantages and applications in biological research.	**10**	**L2**	**CO3**
		OR			
Q.10	**a.**	Explain the principles of ion-exchange chromatography and size-exclusion chromatography. Highlight their applications in biomolecular separation.	**10**	**L3**	**CO3**
	b.	Discuss the principles and applications of HPLC. Compare it with paper chromatography.	**10**	**L2**	**CO3**

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