U.S.N.										

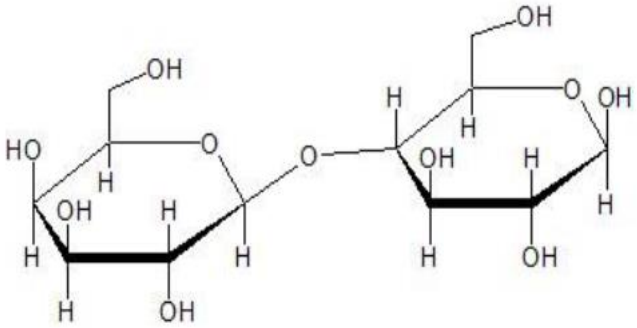
B.M.S. College of Engineering, Bengaluru-560019

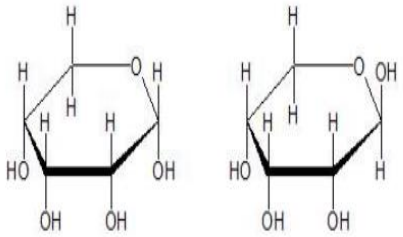
Autonomous Institute Affiliated to VTU

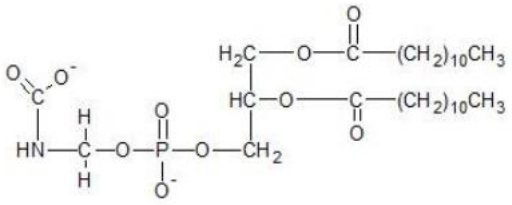
April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: BIOTECHNOLOGY **Duration: 3 hrs.**
Course Code: 23BT3PCBBM / 22BT3PCBBM **Max Marks: 100**
Course: BASICS OF BIOMOLECULES

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	CO	PO	Marks
1	a)	Some people cannot digest the disaccharide lactose. The term for this is known as lactose intolerance. Lactose is shown below. Answer the following questions.  (i) Classify lactose as a mono-, di-, oligo-, or polysaccharide. (1M) (ii) Label anomeric carbons by circling them. Is lactose a reducing sugar? (2M) (iii) Draw an arrow pointing to the glycosidic bond. Is the glycosidic bond connected to both anomeric carbons? (1M) (iv) Classify the glycosidic bonds using the alpha or beta format.(identify the type of linkage) (1M) (v) If the glycosidic bond is hydrolyzed, what are the names of the monosaccharides produced. (if any) (1M) (vi) Give the structures of the monosaccharides produced when hydrolyzed (if any) (2M)	*CO1*	*PO1*	**8**
	b)	In a hospital laboratory, a 10.0 ml sample of gastric juice, obtained several hours after a meal, was titrated with 0.1 M NaOH to neutrality; 7.2 ml of NaOH was required. The patient's stomach	*CO2*	*PO1*	**4**

			contained no ingested food or drink; thus assume that no buffers were present. What was the pH of the gastric juice?			
		c)	Draw the Haworth's projection of anomers of D- fructose.	*CO1*	*PO1*	**4**
		d)	Differentiate between homopolysaccharides and hetero polysaccharides with suitable examples.	*CO1*	*PO1*	**4**
			OR			
	2	a)	Glycogen, Starch and cellulose are made up of the repeating units of glucose but differ in their properties. Justify these differences.	*CO1*	*PO1*	**6**
		b)	The concentration of acetylcholine (a neurotransmitter) in a sample can be determined from the pH changes that accompany its hydrolysis. When the sample is incubated with the enzyme acetylcholinesterase, acetylcholine is converted to choline and acetic acid, which dissociates to yield acetate and a hydrogen ion. In a typical analysis, 15 ml of an aqueous solution containing an unknown amount of acetylcholine had a pH of 7.65. When incubated with acetylcholinesterase, the pH of the solution decreased to 6.87. Assuming there was no buffer in the assay mixture, determine the number of moles of acetylcholine in the 15 ml sample.	*CO2*	*PO1*	**4**
		c)	Differentiate between anomers and epimers giving one example each.	*CO1*	*PO1*	**5**
		d)	Study these Haworth projections to answer the following for each of them. (i) Circle each anomeric carbon (ii) Which of the two is the alpha anomer and which is the beta anomer? (iii) Are these structures considered enantiomers or diastereomers? (iv) Are these monosaccharides reducing sugars? Explain. (v) Can you convert the alpha anomer to a beta anomer? Explain. 	*CO3*	*PO2*	**5**
			UNIT - II			
	3	a)	A common structural feature of membrane lipids is their amphipathic nature. For each of the following membrane lipids, identify the components that serve as the hydrophobic and hydrophilic units and give the structures of the lipids. i) phosphatidylethanolamine	*CO3*	*PO2*	**8**

			ii) sphingomyelin iii) galactosyl cerebroside iv) ganglioside			
		b)	Examine the membrane lipid pictured below and answer the following questions.  (i) Is this lipid classified as a phospholipid or a glycolipid? Give reasons (ii) Is this lipid considered a sphingolipid or a glycerophospholipid? Give reasons. (iii) What fatty acid chains are used in this lipid? (iv) Are they saturated or unsaturated? (v) What functional group enables them to connect to the backbone?	*CO3*	*PO2*	**5**
		c)	What are sterols? Give the structure of a steroid nucleus and explain the role of steroid as hormones giving examples of three hormones and their function.	*CO1*	*PO1*	**7**
			UNIT - III			
	4	a)	A sample (660 mg) of an oligomeric protein of molecular weight 132,000 was treated with an excess of 1-fluoro-2,4-dinitrobenzene (Sanger's reagent) under slightly alkaline conditions until the chemical reaction was complete. The peptide bonds of the protein were then completely hydrolyzed by heating it with concentrated HCl. The hydrolysate was found to contain 5.5 mg of 2 ,4-dinitrophenyl derivative of valine and 2,4-Dinitrophenyl derivatives of the amino groups of other amino acids could not be found. (i) Identify the sequencing strategy used in this experiment (2M) (ii) Explain how this information can be used to determine the number of polypeptide chains in an oligomeric protein. (2M) (iii) What other protein sequencing technique could you employ to determine the primary structure of a protein . Explain its salient features (6M)	*CO3*	*PO2*	**10**

		b)	Classify the following amino acids based on the properties of their "R" group Amino acid 1. Proline 2. Histidine 3. Aspartic acid 4. Glutamine 5. Tyrosine 6. Serine 7. Glycine 8. Threonine 9. Methionine 10. Lysine	*CO1*	*PO1*	**10**
			UNIT - IV			
	5	a)	Two major models have been proposed to explain the cooperative binding of ligands to multi subunit proteins. List the two models and explain their salient features.	*CO1*	*PO1*	**10**
		b)	"Protein folding in cells probably involves multiple pathways." Justify this statement and explain the thermodynamics of protein folding with the help of a suitable diagram.	*CO1*	*PO1*	**10**
			OR			
	6	a)	Explain in detail the Ramachandran plot or stearic contour diagram taking any one example. Add a note on its significance.	*CO1*	*PO1*	**8**
		b)	Which of the following situations would produce a Hill plot with $n_H < 1.0$? Explain your reasoning in each case. (i) The protein has multiple subunits, each with a single ligand-binding site. Binding of ligand to one site decreases the binding affinity of other sites for the ligand. (4M) (ii) The protein is a single polypeptide with two ligand binding sites, each having a different affinity for the ligand. (4M) (iii) The protein is a single polypeptide with a single ligand-binding site. As purified, the protein preparation is heterogeneous, containing some protein molecules that are partially denatured and thus have a lower binding affinity for the ligand (4M)	*CO3*	*PO2*	**12**
			UNIT - V			
	7	a)	What is the numeric relationship between pyrimidine and purine bases in DNA molecules? Is this valid for RNA molecules?	*CO3*	*PO2*	**8**
		b)	List the salient features of the tertiary structure of tRNA	*CO1*	*PO1*	**5**
		c)	Define the melting temperature of DNA and give a mathematical equation for calculating the melting temperature. Graphically illustrate this process.	*CO1*	*PO1*	**7**

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