

2025

## MICROBIOLOGY — HONOURS

Paper : DSCC-3

(Biomolecules and Bioenergetics)

Full Marks : 75

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*1. Answer **any ten** questions :

2×10

- (a) Define an open system and closed system.
- (b) What is a zwitterion?
- (c) Define optical isomers with example.
- (d) Why is RNA not primarily the genetic material? Explain.
- (e) Why butter turns rancid faster than vegetable oil?
- (f) Which form of glucose is more stable? Explain with structure.
- (g) Calculate the molecular weight of a polypeptide containing 75 amino acids.
- (h) What is antivitamin? Give one example.
- (i) What is the utility of iodine number?
- (j) Why phosphoenolpyruvate is called 'energy rich' compound?
- (k) What are prostaglandins?
- (l) Name the coenzyme form of vitamin B<sub>6</sub>. Write down one function of vitamin K.
- (m) What are liposomes?
- (n) What are non-protein and protein parts of an enzyme?
- (o) Name one linear and non-linear polysaccharide each.

2. Answer **any ten** questions :

- (a) What is the primary structure of protein? Why primary structure is crucial for the three-dimensional structure of protein? 1+2
- (b) What is the standard free energy change for the conversion of A to C? If  $\Delta G^\circ$  for  $A \rightarrow B$  is  $-15.5$  kJ/mol and  $\Delta G^\circ$  for  $B \rightarrow C$  is  $+25.8$  kJ/mol. 3
- (c) What do you mean by 'specificity' of enzyme? Calculate the isoelectric pH of an amino acid with  $pK_{a1} = 3.34$  and  $pK_{a2} = 11.5$ .  $1\frac{1}{2}+1\frac{1}{2}$

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- (d) Draw a tripeptide with Asp, Met and Phe. Write down the name of tripeptide. 2+1
- (e) Which vitamin is helpful in healing of wounds? Mention few rich sources of the vitamin. 1+2
- (f) Why  $P^{32}$  and  $S^{35}$  were selected for radiolabeling in Hershey-Chase experiment? Which experiment conclusively prove RNA as the genetic material (in absence of DNA)? 2+1
- (g) Why  $\beta$ -D-glucose is more stable than  $\alpha$ -D-glucose? Which form of glucose is more stable and why? 1+2
- (h) What are quaternary structure of proteins? Give one example. 2+1
- (i) What are  $\omega^3$ -fatty acids? Why are they so important for the body? 2+1
- (j) Write down the structure and biological functions of Glutathione.  $\rightarrow$  Antioxidant 3
- (k) Write down the difference between Cellulose and Glycogen. 3
- (l) Define equilibrium constant. How is it related to Gibb's free energy? 1+2
- (m) Glucose, Fructose and Mannose form same osazone product. Justify. 3
- (n) Draw the structure and name of the following : 1 $\times$ 3
- Acidic amino acid
  - Aromatic amino acid
  - Sulfur containing amino acid.
- (o) How soap removes dirt? Explain. 1+2

3. Answer **any five** questions from the following :

- (a) What is denaturation? Explain the effect of denaturation on the structure of protein. 2+3
- (b) A viral DNA is analyzed and found to have the following base composition in mole present :  
A=32, G=16, T=40, C=12
- What can you immediately conclude about this DNA?
  - What kind of secondary structure do you think it would have? 2+3
- (c) What is mutarotation? Explain why mutarotation is arrested in presence of pyridine. 2+3
- (d) Differentiate between Hemoglobin and Myoglobin. 5
- (e) Which type of membrane lipid contain an acidic oligosaccharide? Give one example. What is 'transforming principle'? Who identified it? 1 $\frac{1}{2}$ +1+1 $\frac{1}{2}$ +1
- (f) Does the R group of the amino acid have any significance? Explain with example. Mention the importance of oxytocin. 3+2
- (g) What is the structural difference between a triacylglycerol and a phospholipid? What is the main difference between the Lock-and-key model and the Induced Fit model? What will be the free energy change, if a reaction is at equilibrium? 2+2+1
- (h) Give one example of sphingolipid with structure. What happens when animal fat is treated with alkali? 2+3