



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B. Tech ( BT )/SEM-7/BT-703A/2011-12**

**2011**

**BIOPHYSICS OF MACROMOLECULES**

*Time Allotted : 3 Hours*

*Full Marks : 70*

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) In an allosteric enzyme
  - a) substrate binding site and the inhibitor binding site are the same
  - b) substrate binding site is different from the inhibitor binding site
  - c) substrate binding site may be same with the or different from inhibitor binding site
  - d) there is no inhibitor binding site.



- ii) Melting point of a DNA molecule
  - a) decreases with G-C content
  - b) decreases with number of associated water molecules
  - c) increases with G-C content
  - d) independent of the above stated parameters.
- iii) Two Cys residues forming a disulphide linkage in a protein molecule
  - a) lie on the same plane
  - b) lie on different planes
  - c) lie either on the same plane or on different planes
  - d) disulphide linkage is not possible in a protein molecule.
- iv) Polyglutamic acid can form a stable alpha helix at
  - a) physiological pH
  - b) highly acidic pH ( $\text{pH} < 4.0$ )
  - c) highly alkaline pH ( $\text{pH} > 11$ )
  - d) at any pH within the pH range.



- v) A combination of weak interaction is
- van der Waals force, electrostatic interaction and disulphide linkage
  - disulphide linkage, hydrogen bonding and hydrophobic interaction
  - ion-dipole interaction, hydrophobic interaction and electrostatic interaction
  - disulphide linkage, hydrophobic interaction and van der Waals force.
- vi) Prolines are
- helix stabiliser
  - helix destabiliser
  - helix breaker.
- vii) The number of bases per helical turn in Z-DNA is
- |         |                   |
|---------|-------------------|
| a) 10.5 | b) 12             |
| c) 9    | d) none of these. |
- viii) Glycosidic bonds are found in
- |                  |                   |
|------------------|-------------------|
| a) DNA           | b) RNA            |
| c) none of these | d) both of these. |
- ix) The diameter of a duplex DNA is
- |                     |                       |
|---------------------|-----------------------|
| a) $10 \text{ \AA}$ | b) $20 \text{ \AA}$   |
| c) $30 \text{ \AA}$ | d) $40 \text{ \AA}$ . |



- x) Which one of the following is the fluorescence probe used in biomolecular studies ?
- a) Methyl red                      b) Acridine orange
- c)  $\beta$ -carotene                      d) Isoprene.
- xi) Lambert-Beers law is related to
- a) X-ray diffraction
- b) Spectrophotometry
- c) Electron microscope
- d) Nuclear magnetic resonance.
- xii) The length of an  $\alpha$ -helical polypeptide chain of 25 amino acids is
- a) 36 nm                              b) 37.5 nm
- c) 40 nm                              d) none of these.

**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

2. Describe the  $\alpha$ -helix and  $\beta$ -sheet of a protein.  $3 \times 5 = 15$   
 $2\frac{1}{2} + 2\frac{1}{2}$
- 3) Write down the five structural differences between *B*- and *Z*- DNA.



- 4) Define weak interactions. 'Weak interactions are more important than covalent linkages of stabilization of a macromolecular structure'. Do you agree with the statement ? Justify your answer 2 + 3
5. Describe the photoconductive and piezoelectric properties of biomolecules.  $2 \frac{1}{2} + 2 \frac{1}{2}$
6. What are amphipathic molecules ? Discuss their interactions with water. 2 + 3

### GROUP – C

#### ( Long Answer Type Questions )

Answer any *three* of the following.  $3 \times 15 = 45$

7. How can NMR spectroscopy be used for the structure determination of biopolymer ? Describe the basic principle of circular dichroism (CD) and optical rotatory dispersion (ORD). What are negative Cotton effects and positive Cotton effects in CD and ORD ? Write brief application of CD and ORD in biological macromolecules. 5 + 5 + 2 + 3
8. a) Define an allosteric enzyme. Draw and explain the kinetics curve ([S] in the X-axis and V in the Y-axis) for an allosteric enzyme with positive cooperativity.



- b) State the postulates of symmetry model (MWC model)

for explaining the properties of an allosteric enzyme.

Explain the alloestric property with the help of this

model.

2 + 4 + 3 + 6

9. Draw a diagram of a light microscope. State the differences

between a light microscope and an electron microscope.

What are the different types of electron microscopes ?

Discuss their importance in studies of biological samples.

5 + 3 + 2 + 5

10. a) What is the melting point of an alpha helix ? Deduce the

equation showing the relation between the melting point

and the chain length.

- b) What do you mean by cooperativity ? Discuss the

molecular basis for the positive cooperativity observed

in helix coil transition.

2 + 5 + 2 + 6



11. a) Describe the primary, secondary, tertiary and quaternary structures of a protein.
- b) Write down Bragg's law. How is it used in X-ray diffraction ?
- 6 + 9

=====