

2021**MOLECULAR BIOLOGY****[GENERAL]****Paper : I**

Full Marks : 100

Time : 3 Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.**Write the answers to questions of each Group in separate books.***Answer all the questions.****GROUP-A****(Biochemistry)****(Marks: 50)**1. Answer the following questions: $1 \times 4 = 4$ a) Mark **True/False** (any **two**):

- i) Uracel is a purine base.
- ii) Maltose is a non-reducing sugar.
- iii) The internal pH of lysosomes are acidic.

b) Fill in the blanks (any **two**):

- i) Ribosomes participate in _____.

ii) _____ is an amino acid.

iii) The number of fatty acids in a triglyceride molecule is _____.

2. Answer any **six** from the following questions: $2 \times 6 = 12$

- a) Write down the functions of mitochondria.
- b) What is Ribozyme?
- c) What is nucleotide?
- d) What are reducing sugars?
- e) What do you mean by isoelectric pH of a protein?
- f) What do you mean by K_m and V_{max} of an enzyme substrate reaction? $1+1=2$
- g) Give example of a disaccharide. Write its monomeric units. $1+1=2$
- h) Why amino acids are amphoteric molecule?
- i) What do you mean by quaternary structure of a protein?

3. Answer any **four** from the following questions: $6 \times 4 = 24$

- a) Classify enzymes according to types of reactions catalyzed by them. 6
- b) What are Fats and Oils? Write a short note on 'Phospholipid'. $2+4$

c) How can C-terminal amino acid of a polypeptide chain be identified by enzymatic reaction? Name the reagents used in Sanger method and Edman degradation method for N-terminal amino acid identification. Briefly discuss the features of an alpha helix.

2+2+2

d) Discuss the differences between eukaryotic and prokaryotic cells.

6

e) What is 'Fluidity' of Plasmamembrane? Name two polysaccharides found in plant cell wall? What are the important functions of cell wall?

6

f) What are 'epimers'? Give example. Name a reducing disaccharide. Write its monomeric units. Why are carbohydrates important in biological system?

2+1+1+2

4. Answer any **one** from the following questions:

10×1=10

a) Explain competitive inhibition of enzyme with suitable example in an enzyme-substrate reaction. How can you identify N-terminal amino acid of a polypeptide chain? Why enzyme is considered as bio-catalyst? How glucose reacts with Fehling's solution?

3+3+2+2=10

b) Name the purine and pyrimidine bases found in nucleic acids. Why DNA is a negatively charged molecule at Physiological pH? Name the forces/interactions that stabilize double helical structure of DNA. What is Chargoff's rule? Write major differences between DNA and RNA.

2+1+2+2+3=10

c) Write short notes on:

i) Golgi Complex

ii) Mitochondria.

5+5=10

GROUP-B

(Biophysics)

(Marks: 50)

5. Answer any **four** questions from the following:

1×4=4

i) The mean and standard deviation of a Binomial distribution are _____ and _____.

ii) From Bragg's law it follows that more the interplanar distance the less is the _____ angle.

iii) The overall magnification of a microscope

is the product of the magnification of the objective and _____ lens.

- iv) X-rays are _____ waves.
- v) Resolution in an electron microscope is of the order _____.
- vi) The standard deviation of 1, 2, 3, 4, 5 is _____.

6. Answer any **six** from the following : $2 \times 6 = 12$

- i) Distinguish between bright and dark field microscopy.
- ii) What is Fick's law of diffusion?
- iii) Define electrophoretic mobility.
- iv) Write two medical applications of X-ray.
- v) State the conditions for a random variable to follow Poisson distribution.
- vi) Write down the equation for the forces acting on a macromolecule in density gradient centrifugation.
- vii) Describe the principle of gel chromatography.
- viii) Briefly mention the role of condenser lens to increase the resolving power of an optical microscope.

7. Answer any **four** of the following: $6 \times 4 = 24$

- a) How do you calculate the viscosity of a liquid using Ostwald's viscometer? Define the fate of an RBC, when it is placed in a hypotonic solution or in a hypertonic solution. $4+2$
- b) State the principle of Density gradient centrifugation. What is Isopycnic centrifugation? State some applications of Analytical Ultracentrifugation. $2+2+2$
- c) X-rays can be used to determine the structure of macromolecules at atomic-level resolution. Explain. 6
- d) Name a few matrices (gel material) used in Gel filtration Chromatography. What is void volume? How many bands do you observe, when you run a heterodimeric protein in Native PAGE and SDS PAGE, respectively? Explain. $2+1+3$
- e) State the difference between 'Transmittance' and 'Absorbance'. What is absorption spectrum? Define Molar extinction coefficient. What is its unit? $2+2+1+1$

- f) Find the standard deviation for the following data set:

12, 6, 7, 3, 15, 10, 18, 5.

State two characteristic features of poisson distribution. 4+2

8. Answer any **one** from the following : 10×1=10

- a) From the following cumulative frequency distribution of marks obtained by 22 students, calculate (i) A.M. (ii) Median (iii) Mode.

<u>Marks</u>	<u>No. of students</u>
Below 10	3
— 20	8
— 30	17
— 40	20
— 50	22

- b) State Lambert-Beer's law. Deduce the mathematical expression for optical density of a solution? What are the limitation of Beer's law? What is isobestic point? Give few applications of absorption spectroscopy.
