B. Sc. Physics Examination, 2022

(3rd Year, 2nd Semester)

Subject : Biological Physics

(Subject Code : UG/SC/DSE/PHY/TH/02/4C)

Time : Three hours   Full Marks : 80

Answer any 4 questions

1. a) What is monochromatic X-ray? Explain its importance in X-ray crystallography.
    b) Explain briefly how X-rays Interact with matter.
    c) What is ionization of gas? Describe the working principle of various detectors based on this ionization of gas.

    3+7+(2+8)

2. a) Describe the units of exposure and dose of radiation.
    b) Explain briefly: i) the Dose Equivalence ii) the Effective Dose iii) the Law of Bergonne and Tribondeau.
    c) Describe the Effect of Radiation on Living Organisms.
    d) A radiographic exposure results in 0.015 Jules of energy absorbed by liver. If the liver weighs 0.9 kilograms, what is the total absorbed dose to the liver?

    4+6+5+5

3. a) Describe the Miller-Urey experiment to mimic the primitive earth condition and the formation of essential biomolecules.
    b) What is meant by the secondary structure of proteins? Describe with the help of α-helix.
    c) Briefly describe the process of translation for the synthesis of proteins from mRNA.
    d) With the help of suitable examples, describe the difference between fibrous and globular proteins, with emphasis on their structure and functions.

    5+4+7+4

4. a) Describe the structure of DNA based on the Watson and Crick model.
    b) Why is the process of DNA replication termed 'semi-conservative'? What are Okazaki fragments?
    c) Why is glucose not stored in the monomeric form by living organisms?
    d) Describe the hydrogen-bonding capability of water molecules.
    e) Show with the help of Gibb's free energy, how dissolving of non-polar solute in water, via hydrophobic interactions is unfavourable.

    7+(2+2)+3+3+3

5. (a) What are lipids? Classify different types of lipids. How does composition of lipids of prokaryotic cell membrane different from Eukaryotic cell membrane?

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(b) Why do you mean by self-assembly of amphiphiles? Explain the thermodymanics

of assembly and hence define critical micellar concentration

(c) State different types of membrane proteins and describe their functions in brief.

(2 + 2 + 2) + (2+ 6)+6

6. (a) What is chain melting transition? Describe with suitable schematic diagram the characteristics of fluid and gel phase of lipid bilayer.

(b) How does cholesterol in bilayer influence the phase behavior and bilayer properties? Draw the phase diagram of lipid-cholesterol membrane.

(c) What are mean curvature and Gaussian curvature of the membrane. Write the free energy in the spontaneous curvature model.

(d) Explain the basic principle of fluorescence microscopy. Draw the optical path in the fluorescence microscopy.

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