

U.G. 6th Semester Examination-2025

PHYSICS

[HONOURS]

Discipline Specific Elective (DSE)

Course Code : PHY-H-DSE-T-04

(Biophysics)

[Old Syllabus]

Full Marks : 60

Time : $2\frac{1}{2}$ 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.*

1. Answer any five questions: $3 \times 5 = 15$
 - a) State the differences between closed and open system.
 - b) Does microgravity effect blood pressure? State the reason in support of your answer.
 - c) Does aneurysm effect blood pressure?
 - d) Write down basic mechanism of active and passive membrane transport.
 - e) State and explain Navier — Stokes equation.
 - f) 'Amino acids are amphoteric' — discuss.
 - g) What is the function of enzymes?
 - h) What are the characteristics of amino acids?

[Turn Over]

2. Answer any five questions: $5 \times 5 = 25$

- a) i) What is rouleaux?
ii) State and explain the first law of thermodynamics. $3+2=5$
- b) Consider a suitable quantum mechanical model to describe the light absorption process in biomolecules and derive the mathematical expression that relates the wavelength of light with the dimension of the biomolecules. 5
- c) i) State the general features of active transport of Na^+/K^+ in the cell.
ii) Is the 'cis' configuration is less stable than the 'trans' configuration of protein? $2+3=5$
- d) How does the entropy of an ideal gas undergoing free expansion change? Derive the associated mathematical relation. 5
- e) Derive the mathematical expression to show the dependence of chemical potential on temperature? 5
- f) i) State and explain Beer-Lambert law.
ii) What is the function of dynein? $3+2=5$
- g) Derive the expression of the concentration profile in a centrifuge rotating with angular speed ω . 5

h) State the basic principle of Feynman Ratchet. How do you explain the mechanism of molecular motor with the help of it? $2+3=5$

3. Answer any two questions: $10 \times 2 = 20$

- a) i) State Bernoulli's theorem for a liquid in a streamline motion. Derive the mathematical expression of it.
ii) Derive the expression of the equation of continuity for a steady state flow of a liquid. Mention the law of conservation associated with it. $(1+4)+(4+1)=10$
- b) i) What are the basic properties of α -helix and β -sheet structure of protein?
ii) What is myoglobin? What is the main function of it?
iii) 'Entropy increases in the process of unfolding of proteins'— explain. $5+1+1+3=10$
- c) Write a short note on: 5+5
 - i) Importance of Casimir interaction in biophysical systems.
 - ii) Sedimentation process in a cell culture.
- d) i) Derive the expression of the concentration of a chemical undergoing second-order reaction.

- ii) How does Specific absorption rate (SAR) depend on the density of system in the context of Joule heating of tissues?
 - iii) 'DNA stretching is performed using optical tweezers'- explain. 5+2+3=10
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