U.G. 6th Semester Examination-2024

PHYSICS

[HONOURS]

Discipline Specific Elective (DSE)

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

(Biophysics)

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: 3×5=15

a) What is the function of membrane transporter? Give an example of membrane transporter.

b) What is the positive role of cholesterol in our body?

c) Write down the expression of Clausius-Mossotti equation explaining the meaning of each term of the equation.

d) What is Casimir interaction? Does it depend on the geometry of the boundaries of material?

e) Write down the expression of Lennard-Jones Potential energy. Explain the meaning of each term.

f) What are the differences between DNA and RNA?

g) Give three examples of nondigestible carbohydrates.

h) State and explain zeroth law of thermodynamics.

2. Answer any **five** questions: 5×5=25

a) i) Give an example of an organism in which cytoplasmic steaming is observed.

ii) What is the parameter used to measure Joule heating of tissue? Write down the expression of it explaining the meaning of each term involved. Give an example of the technique of medical treatment in which this concept is used.

1+(1+2+1)=5

b) What are the different classes of digestible carbohydrates? Give example of each class of carbohydrates. 5

c) i) What is Venturi effect?

ii) Calculate the average speed of the blood when the blood flow through a large artery of radius 2.6 mm is found to be 25 cm long. The pressure difference across the ends of the artery is known as 380 Pa. Given, coefficient of blood viscosity = 0.0027 N.s/m^2. 2+3=5

d) Briefly describe the structure of DNA. 5

e) What is Levinthal's paradox related to protein folding? State the resolution to this paradox. 5

f) i) Write down Gibbs free energy as a function enthalpy of the system.

ii) Write down the expression that represents overall reaction of ATP hydrolysis and synthesis. What is the associated change in the Gibb's free energy? 1+(2+2)=5

g) Derive Poiseuille's equation of fluid dynamics. 5

h) i) Write down Henderson-Hasselbalch equation.

ii) State and explain Fick's first law of diffusion. 2+3=5

3. Answer any **two** questions: 10×2=20

a) i) How does Boltzmann factor play crucial role in the field biology? Give three examples in support of your claim.

ii) Does life violate the second law of thermodynamics? 6+4=10

b) i) State Bernoulli's equation in terms of law of conservation of energy.

ii) Explain turbulent and laminar flow of a fluid.

iii) Calculate the minimum pressure required to force the blood from heart to the top of the head at vertical distance 0.4m. Assume the density of blood to be 1038 kg/m^3. Friction is to be neglected.

iv) Write down and explain the variation of concentration of a colloidal suspension of particles such as yeast cells with depth. 2+3+3+2=10

c) Write a short note on (i) Brownian motors, and (ii) ATP synthesis in mitochondria. 5+5=10

d) i) What is the function of myosin?

ii) How many myoglobin molecules are associated with a hemoglobin molecule?

iii) Write down the expression that represents photosynthesis process in chloroplasts.

iv) Does coasting distance of a bacterium depend on the viscosity of the medium? Derive necessary mathematical expression in support of your claim. 2+1+2+5=10