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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2025 - 2026)

Subject: Biophysics and Bioinstrumentation

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C**. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

20

1. Attempt all parts:-

- (1.1) Most abundant lipid in plasma membrane is (CO1, K1) 1
- (a) Cholesterol
 - (b) Sterol
 - (c) Glycolipid
 - (d) Phospholipids
- (1.2) Tonicity is defined as: (CO1, K1) 1
- (a) The total solute concentration in a solution
 - (b) The ability of a solution to cause a cell to gain or lose water
 - (c) The pressure exerted by a fluid on the membrane
 - (d) The movement of solutes across the membrane
- (1.3) Influx of sodium ions into the neuron will cause which of the following? (CO2, K1) 1
- (a) Repolarization
 - (b) Hyperpolarization
 - (c) Polarization
 - (d) Depolarization
- (1.4) The junction which is present between two neurons is called the _____ (CO2, K1) 1
- (a) Synapse
 - (b) neuromuscular
 - (c) desmosome
 - (d) gap junctions

- (1.5) Which type of cell signaling involves the release of signaling molecules into the bloodstream for distant target cells? (CO3, K1) 1
- (a) Autocrine signaling
 - (b) Paracrine signaling
 - (c) Juxtacrine signaling
 - (d) Endocrine signaling
- (1.6) F-type ATPases are primarily involved in: (CO3, K1) 1
- (a) Synthesizing ATP in mitochondria and chloroplasts
 - (b) Pumping protons across cell membranes
 - (c) Exporting drugs and toxins from cells
 - (d) Transporting glucose across the membrane
- (1.7) The linear sequence of amino acids within a protein is an example of _____ protein structure. (CO4, K1) 1
- (a) primary
 - (b) secondary
 - (c) tertiary
 - (d) quaternary
- (1.8) Number of hydrogen bonds between adenine and thymine? (CO4, K1) 1
- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
- (1.9) The QRS complex represents the depolarisation of the _____ (CO5, K1) 1
- (a) ventricles
 - (b) atria
 - (c) valve
 - (d) purkinje fibers
- (1.10) In muscle contraction, this ion is essential (CO5, K1) 1
- (a) Cl
 - (b) Ca
 - (c) K
 - (d) Na

2. Attempt all parts:-

- (2.1) How is biomimicry used in real life? (CO1, K1) 2
- (2.2) What is the main difference between the Nernst equation and the Goldman-Hodgkin-Katz equation? (CO2, K1) 2
- (2.3) What are metabotropic & ionotropic receptors? (CO3, K1) 2
- (2.4) Draw the structure of ribose and deoxyribose sugar? (CO4, K1) 2
- (2.5) What do you understand by mechanobiology? (CO5, K1) 2

SECTION-B

30

Answer any one of the following:-

- (3.1) What do you understand by tonicity? What will happen to the cells if they are placed in isotonic, hypotonic and hypertonic solution? (CO1, K1) 6
- (3.2) Describe the structure and functions of aquaporins with suitable diagram? (CO1, K1) 6

Answer any one of the following:-

- (3.3) Why are neurons called excitable cells? Write the key differences between excitable and non-excitable cells? (CO2, K1) 6
- (3.4) What do you understand by conduction disorder? What are the common causes of alterations of heart conduction? (CO2, K1) 6

Answer any one of the following:-

- (3.5) Discuss in detail the three stages or process of cell signalling pathway? (CO3, K2) 6
- (3.6) What are the main components of cell surface receptor? Also discuss about the different forces that affect the receptor and ligand binding? (CO3, K2) 6

Answer any one of the following:-

- (3.7) What are torsional angles? Discuss about the conformations of polypeptide chain? (CO4, K2) 6
- (3.8) Why do we need Ramachandran plot? Why are glycine and proline commonly excluded from Ramachandran plot? (CO4, K1) 6

Answer any one of the following:-

- (3.9) Discuss in detail the mechanism of cell migration? (CO5, K2) 6
- (3.10) Explain how PET imaging is used in cancer diagnosis and monitoring? (CO5, K2) 6

SECTION-C 50

4. Answer any one of the following:-

- (4.1) What are the main components of the plasma membrane? How does the plasma membrane contribute to maintaining homeostasis? (CO1, K1) 10
- (4.2) How are membrane proteins classified? What are the things that membrane proteins do? What might happen if cell membranes did not have pores? (CO1, K1) 10

5. Answer any one of the following:-

- (5.1) Explain the mechanism of generation and propagation of action potential? (CO2, K2) 10
- (5.2) How many types of synapses are there? Which synapse is faster? What is the main purpose of synapse? What would happen if there were no synapses? (CO2, K1) 10

6. Answer any one of the following:-

- (6.1) Illustrate the process by which light leads to the activation of rhodopsin and the subsequent visual signal transduction in photoreceptor cells? (CO3, K3) 10
- (6.2) "Sodium potassium pump is an example of active transport". Discuss? Also classify about the different types of transport ATPases? (CO3, K2) 10

7. Answer any one of the following:-

- (7.1) Write a brief note on protein folding? Also discuss about the molecular chaperone's mechanism in protein folding? (CO4, K2) 10

- (7.2) Explain the principle of X-ray crystallography and how it is used to determine protein structure? (CO4, K2) 10
8. Answer any one of the following:-
- (8.1) Discuss in detail about molecular motors? Give some examples? What is the importance of molecular motors? (CO5, K2) 10
- (8.2) How does techniques like Single Neuron Recording and Patch-Clamp Recording help in the study of synaptic transmission? Discuss both the techniques in detail? (CO5, K2) 10

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