BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: IMSc **SEMESTER : VI**
BRANCH: PHYSICS **SESSION : SP/2025**

SUBJECT: PH328 BIOPHYSICS

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Which organelles in the biological cell have proton pump? What kind of ion is pumped across such organelle?	[2]	1	I
Q.1(b)	What is the transient time duration of Autophagosome? Describe the process of formation of autophagosome	[3]	1	II
Q.2(a)	Draw a schematic of relative internal concentration of sodium with respect to potassium for the intracellular and extracellular regions.	[2]	1	II
Q.2(b)	Derive a general one dimension transient heat flow equation between the regions of higher and lower temperature.	[3]	1	III
Q.3(a)	When external temperature drops to sub-freezing temperature, what is the reason behind keeping the body's inner core to normal temperature of 37℃?	[2]	2	IV
Q.3(b)	Calculate the conductive rate of heat flow through the plasma membrane of a living cell. Consider inner and outer radius of the cell besides membrane thickness.	[3]	2	V
Q.4(a)	Calculate the permeability of the sodium ion with respect to potassium ion for a cell in depolarized state by utilizing the table as shown below:	[2]	2	III

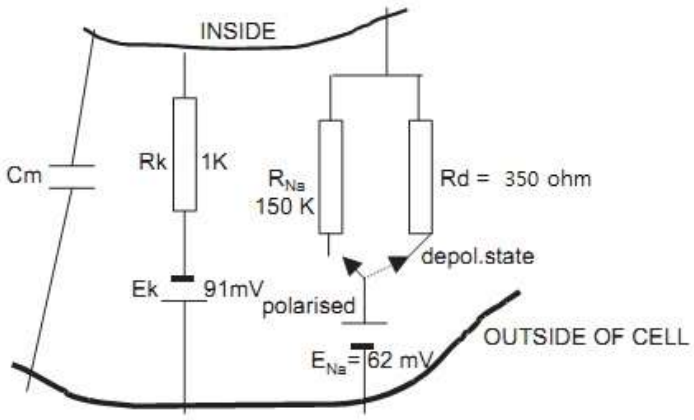
	Na^+	K^+
Intracellular	8	140
Extracellular	140	4

Q.4(b)	A hypothetical cell is permeable only to a divalent cation with a concentration of 120 mEq/l inside the cell and 26 mEq/l outside the cell. An external power supply is used to apply a potential of +25 mV across the cell membrane. Calculate the rest potential of the hypothetical cell. In which direction divalent cations will move across the membrane. What will be the inside and outside concentration of the divalent cation across the membrane to compensate the external power supply.	[3]	2	IV
Q.5(a)	Chose the correct answer for the questions written below:	[2]	3	I

(a1). Bioelectric signals arise from the propagation of
□ Electrode potential □ Action potential □ Zeta potential
□ Coulomb potential
(a2). The transient changes in the potential across the cell membrane is called
□ Action Potential □ Zeta Potential □ Scalar Potential □ Vector Potential
(a3). The cell membrane surface is made up of a bilayer of
□ Glycerolipids □ Glycerophospholipids □ Phospholipids □ Sphingolipids
(a4). The proteins that work as a pump and channel for signal transmission is called
□ Peripheral protein □ Integral protein □ Keratin
□ Collagen

PTO

Q.5(b) Using the concept of electrical analog of the cell, calculate the cell potential for a depolarized cell as shown in the figure below: [3] 3 V



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