Department of Biosciences and Bioengineering, IITG

Biophysics -BT 301 **End Sem Exam** Date: 22nd Nov 2021

Time: 2.00 to 5.00 p.m (3 hrs) Maximum Marks:60

Please attempt all questions. Scan the answer sheet and upload to MS Teams (Assignment section) as a PDF (NAME_RollNO:XXXX.pdf)

If answers are found similar between students, you will have a VIVA with Instructor and TAs

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Name of the student:……. Roll no:……..…….. Total Marks:

1.a Write briefly about cell membrane structure **[2 Marks]**

1.b. Can cell membranes change shape? **[2 Marks]**

1.c. Write down mathematical expressions for stretching, bending, compression and shear for biological membranes. **[2 Marks]**

1.d. Explain concept of vectorization used in Matlab tutorial scripting. **[2 Marks]**

1.e. With reference to biological membrane, depict energetics of beam stretching using a figure and equations **[2 Marks]**

2.a. How may a neuron maintain its standard Resting Membrane Potential (RMP) to facilitate action potential propagation through its axon despite a moderate increase in the concentration of cuprous ions (Cu+) outside the cell, given that the change in concentration did not compromise the structural integrity of the neuronal membrane? Explain using the Goldman – Hodgkin – Katz equation for RMP**.** **[3 Marks].**

2.b. Electrode potential of zinc ions is 0.70V. What will be the potential of a 2M solution at 310K? **[2 Marks]**

2.c. Give few applications of Nernst Equation. **[2 Marks]**

2.d. Find the Cell Potential of the electrochemical cell in which the cell reaction is: $Pb^{2+} + Cd \rightarrow Pb + Cd^{2+}$; Given that $E^{o}_{cell} = 0.277$ volts, temperature = 35ºC, $[Cd^{2+}] = 0.02M$, and $[Pb^{2+}] = 0.2M$. **[3 Marks].**

3.a. Discuss Action potential of a neuron from an electrical viewpoint**.** Highlight how frequency coding is achieved by using a stimulating electrode and battery source in squid neurons **[4 Marks].**

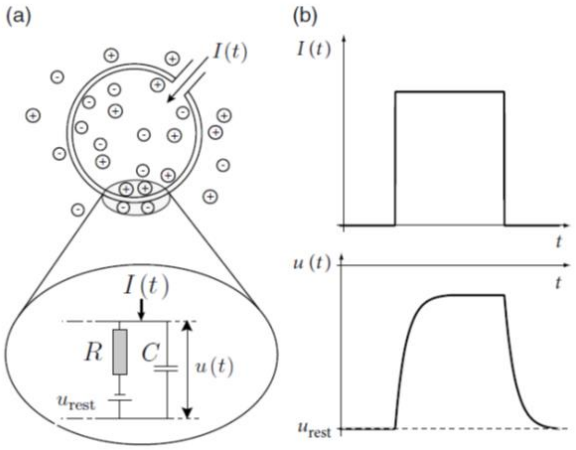
3.b. What are neurotransmitters? **[2 Marks].**

3.c. Write the equation linking ionic current and membrane permeability in a neuron. Briefly explain **[3 Marks].**

3.d. Action potential can have varying shapes. Select one of the below

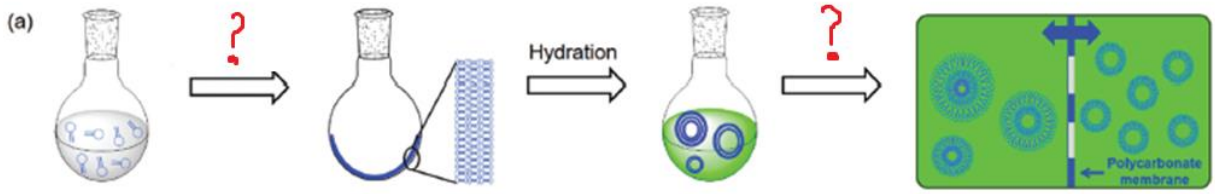
i) False ii) True iii) Question framed is wrong iv) None of the above **[1 Mark].**

4.a. What concept is illustrated below **[3 Marks].**



4.b. Write about classification of Liposomes **[2 Marks].**
4.c. Explain the equation related to Dynamics of Lipid Monolayer **[3 Marks].**
4.d. Briefly write how Scanning Tunnel Microscopy works to image individual biomolecules **[2 Marks]**

5.a. In Hodgkin Huxley model, if rate of change of $I(t)$ with respect to time at some instant is 0.2 mA/S and value of $I(t)$ at that instant is 1mA. Determine the sum of ionic currents at that instant. Take C=100 microFarad. Assume U is a function of input current. $U = f\{I(t)\}$
$f(x) = e^{-x} + x^2$ **[3 Marks]**
5.b. Explain the below concept. Fill up the question mark as well **[3 Marks]**



5.c. Sketch how multiple polypeptide chains form protein aggregates **[2 Marks]**
5.d. Mention any four biophysical methods used to study biomolecules **[2 Marks]**

6.a. Benefits of drug loading in Liposomes **[2 Marks]**

6.b illustrate with (SELECT ONE- the algorithm or pseudo Matlab code or flowchart) for the below question given peptide accession number **[3 Marks]**

1. Commands to load or import the Human HBB (P68871) peptide sequence to a variable directly to MATLAB workspace from online peptide banks.
2. How to find if any of the 20 amino acids are absent in the protein
3. Also give codes to determine isoelectric point and molecular weight of the protein

6.c What are the characteristics of drug delivery system **[2 Marks]**

6.d Discuss about Phase Transition Temperature of Liposome **[3 Marks]**