BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: …… Roll No.: ……..

Branch: …… Signature of Invigilator: ……

Semester: IVth Date: 02/05/2022 (MORNING)

Subject with Code: **BE215 CELLULAR ELECTROPHYSIOLOGY**

	Section A (30)	Section B (20)	Total Marks (50)
Marks Obtained			

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.Tech **SEMESTER : IV**
BRANCH: Biotechnology **SESSION : SP/22**

SUBJECT: BE215 Cellular Electrophysiology

TIME: 2 hours **FULL MARKS: 50**

Section A (30 marks): All questions are compulsory and carry one marks each. In this section, the symbols have their usual meaning.

1. Rapid influx of Na^+ in cell creates-
   (a) Hyperpolarization (b) Depolarization
   (c) Defective polarization (d) Repolarization

2. In mammals, pressure sensor is present on-
   (a) Skin (b) Nose
   (c) Eyes (d) Ears

3. Repeated automatic generation of action potential is generated due to-
   (a) Sodium-Calcium pump (b) Sodium-Potassium pump
   (c) Slow leakage of Na^+ (d) Slow leakage of K^+

4. Cell maintains intracellular negativity-
   (a) Due to ionic concentration imbalance (b) Due to selective properties of plasma membrane
   (c) Large negative ions present inside the cell (d) All of these

5. Intracellular and extracellular K^+ ratio in large nerve fibre is approximately-
   (a) 35:1 (b) 1:1
   (c) 1:10 (d) 1:35

6. Cells use ionic pumps to balance its internal environment. These pumps are-
   (a) Passive in nature (b) Diffusive in nature
   (c) Active in nature (d) None of these

7. Cellular electricity can be measures with-
   (a) Patch clamping (b) Voltage clamping
   (c) Current clamping (d) All of above

8. Diode is principally-
   (a) A passive component (b) An active component
   (c) An inductive component (d) A capacitive component

9. Cellular membrane as overall shows electrically-

(a) Conductive in nature
(b) Inductive in nature
(c) Capacitive in nature
(d) Resistive in nature

10. Resting cell is electrically-

(a) Neutral
(b) Positive
(c) dynamic
(d) Negative

11. Goldman's equation is important for the measurement of-

(a) Cellular ionic potentials
(b) Cellular resting potential
(c) Diffusion coefficient
(d) Cellular surface electricity

12. Cardiac muscle action potential is delayed due to involvement of-

(a) Excess intracellular Na^+
(b) Excess extracellular K^+
(c) Slow influx of Ca^{++}
(d) Na-K pumping activity

13. Leakage of Na^+ inside the cell create-

(a) Elevation in resting potential
(b) Reduction in resting potential
(c) Elongation in resting potential
(d) Hyperpolarization

14. In concept of linear membrane, the relationship between current, conductance and voltage can be illustrated as:

(a) $I_m = G_m (V_m - E_i)$
(b) $I_i + I_C = G_m (V_m - E_i)$
(c) $I_C = G_m(V_m - E_i)$
(d) $I_i = G_m (V_m - E_i)$

15. Name of the scientists who proposed the mathematical model of neuron are-

(a) Rall
(b) Hodgkin and Huxley
(c) Katz
(d) Goldman

16. The total cellular membrane current in parallel conductance model can be written as:

(a) $I = I_C / (I_{Na} + I_K + I_{Cl})$
(b) $I = I_C + I_{Na} + I_K - I_{Cl}$
(c) $I = I_C + I_{Na} + I_K + I_{Cl}$
(d) $I = I_C - I_{Na} + I_K + I_{Cl}$

17. The Nernst equation calculates the emf of cells-

(a) Fails in accurate calculation
(b) Considers the permeability of ions
(c) Accurate in complex dynamism
(d) Not applicable in cell emf

18. The Rall's model of neurons-

(a) provides a theoretical framework for understanding the spread of current and voltage in complicated dendritic trees.

(b) provides the model to linearize the dendritic branches of neurone to create a linear framework,

(c) simplifies the complexity of branching of neurons.

(d) All of above

19. The membrane time constant for signal transmission in an elongated neuron cab be-

(a) $\tau_m = I_m C_m$

(b) $\tau_m = R_m C_m$

(c) $\tau_m = G_m C_m$

(d) $\tau_m = R_i C_i$

20. Ohm's law is applicable in cellular electrophysiology in-

(a) calculation of ionic drift

(b) calculation of ionic diffusion

(c) correlation between ionic drift and diffusion

(d) calculates the induction of charges

21. The length constant λ can be equated as-

(a) $(r_i / r_m + r_o)^{1/2}$

(b) $(r_m / r_i + r_o)$

(c) $(r_m / r_i + r_o)^{1/2}$

(d) $(r_m / r_i + r_o)^{1/4}$

22. Calcium current produced in the cell

(a) Follows the same laws as Na and K currents

(b) Follows the same laws as Na but not the K currents

(c) Calcium ions are immobile and does not produce ant current

(d) Differs from the laws of Na and K currents totally

23. The primary function of "Bicarbonate-Cl" exchanger is-

(a) To keep intracellular pH high

(b) To keep the intracellular pH high

(c) To pump bicarbonate ions out to balance the pH

(d) This is a simple active transport present in a cell

24. Continuous epileptic spike discharge is evident due to-

(a) Hyperactivity of neurons and active EPSP

(b) Hyperactive neurons and excessive discharge of neurotransmitters

(c) IPSP alone

(d) Both EPSP and IPSP

25. Which of the following is responsible for generation of interneuronal action potentials?

(a) IPSP

(b) EPSP

(c) Both of them

(d) Neurotransmitters

26. Chemical synapses are-

(a) Narrower than ionic synapses
(b) Wider than ionic synapse
(c) Creates ionic bridges with the help of neurotransmitters
(d) Generally hypothetical and not present

27. Which one of the following can be evaluated electrophysiologically?

(a) Cardiac muscle contraction and relaxation
(b) Cardiac valves opening and closure
(c) Cardiac blood flow
(d) Coronary artery blood flow

28. Evaluation of firing of a bunch of similar types of neurons is called as-

(a) Macroscopic study
(b) Mesoscopic study
(c) Microscopic study
(d) Complex action potential study

29. Highest frequency of muscle signals can be in the range of-

(a) 100 Hz
(b) 10 Hz
(c) 10 KHz
(d) 40 Hz

30. Which is not a brain signal?

(a) EEG
(b) ECoG
(c) Neuronal discharge
(d) EOG

Section B (20 marks): Answer any five questions. Each question carries four marks.

1. Explain different types of transport mechanisms available for ionic transport across the cell membrane.
2. Draw and label the general action potential curve. Write a note on the calculation of resting potential of large nerve fibres.
3. Discuss the four important physical laws related with the ionic transport across the plasma membrane.
4. Using physical laws of ion movement, derive the Nernst equation for a resting cell membrane. Write two examples of active ion exchanger mechanisms.
5. Write a note on the mechanism of ionic movement within the layers of biological membrane.
6. Draw and discuss the parallel conductance equivalent circuit representation model for a biological membrane.
7. Describe the current flow mechanism in a uniform cylindrical nerve fibre of infinite length.
8. Draw and explain the simplified electrical circuit for the “Inhibitory & Excitatory Post Synaptic Potentials” in neuronal system.
9. Write notes on the types and mechanism of synaptic transmission.
10. Illustrate different types of electrical biosignals. Write a note on the signal characteristics of three electrical biosignals.