Reg. No.															

B.Tech. DEGREE EXAMINATION, MAY 2024

Seventh Semester

18BME469T -NEURO REHABILITATION AND HUMAN MACHINE INTERFACE

(For the candidates admitted from the academic year 2018-2019 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours Max. Marks: 100

	Marks	BL	CO	PO

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

1. Classical conditioning is an example of 1 1 1 1

(A) Declarative memory (B) Sensitization

(C) Priming (D) Operant conditioning

2. Delayed neuronal death following ischemia refers to 1 2 3 4

(A) Swelling and disintegration of affected neurons (B) The deliberate cutting of a nerve fiber

(C) Progressive death of neurons following a disruption of blood supply to the brain (D) Removal or elimination of synapses from a neuron

3. Synapse stripping refers to 1 1 1 1

(A) Removal or elimination of synapses from a neuron (B) Degeneration of neuron located upstream of an injury site

(C) Shrinkage or reduction in size of neurons no longer receiving input (D) Disruption of blood flow to the central nervous system

4. What is the main function of basal ganglia? 1 1 2 4

(A) Processing sensory input (B) Controlling motor behaviour

(C) Generating self-sustaining neural patterns (D) Regulating reward learning

5. What is the main function of somatosensory system? 1 1 2 3

(A) Controlling the muscle movements (B) Processing bodily sensations

(C) Regulating body temperature (D) Maintaining balance and coordination

6. Which of the following is NOT an immediate consequence of injury or sensory loss? 1 3 2 3

(A) Impaired reflexes (B) Altered sensory integration

(C) Sensory reorganization (D) Increased sensory perception

7. What contributes to the optimization of neural circuits, involved in specific movements? 1 2 2 4

(A) Activity dependent plasticity (B) Flexion-withdrawal reflexes
(C) Golgi tendon reflexes (D) Proprioceptive reflexes

8. The motor cortex receives input from various sensory areas and generates motor commands that are transmitted to 1 2 2 3

(A) The brainstem (B) The cerebellum
(C) The spinal cord (D) The thalamus

9. Which invertebrate can regenerate its entire body, including brain? 1 1 3 4

(A) Nematode (B) Lamprey
(C) Planarian (D) All invertebrate

10. Which developmental event leads to the loss of axon regeneration in frogs? 1 2 3 4

(A) Spinal cord transection (B) Thyroid hormone increase
(C) Myelin formation (D) Glial scar formation

11. Which type of neurons play a crucial role in facilitating axon regeneration in the peripheral nervous system? 1 2 3 4

(A) Schwann cell (B) Oligodendrocytes
(C) Microglia (D) Astrocytes

12. Which protein plays a crucial role in inhibiting nerve regeneration and axon growth in the central nervous system? 1 1 3 4

(A) Myelin-associated glycoprotein (MAG) (B) Oligodendrocyte myelin glycoprotein (OMgp)
(C) NOGO (D) Paired immunoglobulin-like receptor (PirB)

13. What is a feature of advanced human machine interface system? 1 2 4 4

(A) Low cost (B) Complex system
(C) Performs simple processing (D) Does not utilize feedback

14. Which of the following neuroimaging modality uses BOLD response to measure the brain activity? 1 1 4 4

(A) EEG (B) ECOG
(C) Intracortical recording (D) FMRI

15. Which control signal has frequency less than 1 Hz? 1 1 4 4

(A) Slow cortical potentials (B) P300
(C) SSVEP (D) Sensory motor rhythms

16. What is the reason for using a hybrid or combined FNIRS-EEG system? 1 5 4 12

(A) Less number of electrodes are used (B) Increases the number of control commands for BCI
(C) Easy signal processing (D) Binary classification is efficient

17. Which interface provides the patient with information about the current status and the progress of the training during neurorehabilitation? 1 1 5 4

(A) User (B) Mechanical
(C) Control (D) Feedback

18.	What is recommended duration for the first training session of robot-assisted treadmill training? (A) 60 min (B) 20 min (C) 10 min (D) 100 min	1	1	5	12
19.	What is the advantage of using robotics for pediatric neurorehabilitation? (A) For enhancing cognitive skills (B) For enhancing motor development (C) For enhancing emotional well-being (D) For enhancing growth	1	4	5	4
20.	The method involved in the delivery of electrical pulses to specific neuroanatomical targets is (A) Electrical muscle stimulation (B) Sensory prosthetics (C) Deep brain stimulation (D) Transcranial magnetic stimulation	1	2	5	4

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

		Marks	BL	CO	PO
21.	What is denervation? Explain its significance in contrast to the axotomy.	4	3	1	1
22.	Explain habituation and sensitization learning process with suitable example.	4	4	1	1
23.	What are different types of plasticity in human somatosensory system?	4	2	2	4
24.	What is TAV? Explain its role in neuro-degenerative and disorders like Parkinson and dementia.	4	5	3	3
25.	What are direct ways of measuring brain activity in BCI system?	4	2	4	12
26.	Describe multi-modal HMI with their advantages and disadvantages. Give an example of multi-modal BCI system.	4	2	6	12
27.	What are specific training goals for robot-assisted gait training?	4	1	5	12

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

		Marks	BL	CO	PO
28. a.	Discuss the significance of the limbic network in relation to motor control, memory and learning. Explain its functions and mechanisms.	12	4	2	4
	(OR)				
b.	How does non-associative learning occur in APLYSIA, and write are neural mechanisms that underlie short-term sensitization?	12	5	1	1
29. a.	Explain the concept of latency and its effects on human motor response to visual stimuli? Use an example to demonstrate how latency can influence motor responses, consider the role of neuroplasticity in shaping these responses.	12	6	2	4
	(OR)				

b.	Explain the roger Sperry's chemo affinity hypothesis along with its key mechanisms for the development of topographic axonal terminations.	12	3	3	4
30. a.	How does error augmentation impact sensor motor interaction and what role does it play in neurorehabilitation? Explain with an example to illustrate its importance in regeneration in the injured nervous system.	12	5	2	4
	(OR)				
b.	What is IN-1 monoclonal antibody? State and explain the steps involved in making of IN-1 monoclonal antibody.	12	2	3	3
31. a.	What are various control signals that can be used in EEG-based BCI system? Explain each along with their applications.	12	2	4	4
	(OR)				
b.	Explain in detail the applications of human machine interface systems.	12	1	4	4
32. a.	What is in intracortical BCI system? What are its advantages and disadvantages? How is it used for communication and control applications?	12	2	6	3
	(OR)				
b.	What are the clinical applications of robotics and technology in children undergoing lower extremity rehabilitation?	12	1	5	12

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