GENERIC ELECTIVE COURSE -21

Neurobiology

Zoo-GE -21

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Neurobiology **Zoo-GE-21**	**2**	**2**	**0**	**2**	**As per the Program Eligibility**	**Zoology**

Learning Objectives

The learning objectives of this course are to:

- Understand the fundamental structure and function of the nervous system.
- Explore key concepts in Neurobiology in relation to non-zoology disciplines.
- Analyze the relationship between neurobiology and other areas of study.
- Develop critical thinking skills in evaluating neurobiological principles.

Learning Outcomes

By studying this course, students will be able to:

- Comprehend the structure and function of the nervous system, including neurons, glial cells, and synaptic transmission.
- Apply knowledge of neurophysiology, including action potentials, membrane potentials, and sensory-motor systems.
- Analyze the relationship between basic principles of neurophysiology and higher brain functions such as learning, memory, and behaviour.
- •Identify and discuss common neurological disorders and their underlying neurobiological mechanisms.
- •Evaluate interdisciplinary applications of neurobiology in fields such as psychology, medicine, and technology.
- •Develop critical thinking skills through discussions, assignments, and examinations, fostering an understanding of neurobiological principles applicable to non-zoology disciplines.

SYLLABUS

THEORY **30 Hrs**

UNIT 1: Introduction to Neurobiology **3 hrs**

Overview of the nervous system and its subdivisions; Structural and functional differences between Neurons and Neuroglial cells; Composition and role of CSF, Blood-Brain barrier.

UNIT 2: Neurophysiology **3 hrs**

Excitability of Neurons; Ion channels and membrane potentials, Generation of Action potentials. Excitatory and Inhibitory post-synaptic potential.

UNIT 3: Neuronal Communication and Higher Brain Functions **14 hrs**

Types of Synapses, Receptors, and Neurotransmitters. Information processing by the nervous system: Sensory receptors and their types; Responses to key sensory stimuli/ impulses: Light (Vision), Smell (Olfactory), Auditory (Hearing), Touch (Tactile) and Taste (Gustatory). Higher Brain Functions: Brain regions and their specialized functions: Learning and Memory, Emotions and Behaviour. Overview of some Neurological Disorders (Alzheimer's, Parkinson's, Schizophrenia, etc.).

UNIT 4: Neurobiology and Interdisciplinary Studies **10 hrs**

Applications of Neurobiology in Psychology, and Medicine: Neural mechanisms in maintenance of Circadian rhythms and their relationship to sleep-wake cycles; Sleep-related disorders: insomnia, sleep apnea, and shift work disorder; Role of sleep in mood regulation, stress (anxiety and depression) management; Mental wellness: Role of lifestyle, mindfulness, and early intervention; Advances in neuroscientific research: Brain imaging tools (EEG, fMRI, PET) Brain-Computer Interfaces (BCIs).

PRACTICALS **60 hrs**

(Laboratory periods: 15 classes of 4 hours each)

1. Microscopic examination of neuron structure using prepared slides.
2. Identification of different types of neurons (e.g., motor neurons, sensory neurons) and glial cells (e.g., astrocytes, oligodendrocytes) under the microscope.
3. Study of Anatomy of the Mammalian Brain (from slaughterhouse) or by using brain models (Plastic or clay anatomical teaching models, graphics, videos, etc. can be used).
4. Histological study of neurons and myelin sheath (Nissl and Luxol Fast Blue staining.)
5. Analysis of neurological and psychiatric disorders (e.g., Alzheimer's, Parkinson's, Schizophrenia) through clinical case vignettes and brain imaging.

Project on any one of the following topics:

1. Reaction Time and Sensory Coordination
2. Sleep Diary and Memory Recall Analysis
3. Case Study on Ethical Implications of BCIs or Neuro-prosthetics

4. Role of Brain Science in Advancing Artificial Intelligence

Essential/recommended readings:

1. Mark F. Bear, Barry W. Connors, and Michael A. Paradiso (2015). Neuroscience: Exploring the Brain. IV Edition.
2. Kandel, E.R., Schwartz, J.H. and Jessell, T.M. (2000). Principles of Neural Science. IV Edition, McGraw-Hill Companies.
3. Kandel, E.R., Schwartz, J.H. and Jessell, T.M. (1995). Essentials of Neural Science and Behavior. I Edition, New York: McGraw-Hill

Suggested readings:

1. Squire, L., Berg, D., Bloom, F. E., du-Lac, S., Ghosh, A., Spitzer, N. C. (2012). Fundamental Neuroscience, IV Edition, Academic Press Publications.
2. Purves, D. et al., (2017) Neuroscience, VI Edition. Oxford University Press.
3. Neuroethics: Defining the issues in THEORY, practice, and policy (2nd edn). Edited by Judy Illes
4. Brain-Computer Interfaces: Principles and Practice (2012). Editors: Jonathan R. Wolpaw, Elizabeth Winter Wolpaw. Oxford University Press

NOTE: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.