Semester VII

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 (BCH-DSE-10)	4	2L		2P	Class XII with Science and Biology	-

Learning Objectives

The course neurobiology being offered aims to provide the students with an understanding of the cellular and molecular mechanisms operating in the human brain. Students will learn the electrical and signaling pathways that operate in the neurons. The objective of this course is also to enable students to comprehend the transduction of external signals and the integration of this information into higher level brain functioning.

Learning outcome

- Students would be introduced to neuroscience and Cellular neurophysiology
- Students would understand the anatomical layout of the nervous system relevant to physiological functions.
- Students would be able to appreciate the excitable properties of neurons and the function of synapses and explore neural circuits along with important neurotransmitters.
- Students will gain understanding of cellular and molecular mechanisms governing neural development, plasticity, and the establishment of memory.
- They would also comprehend the nature and causes of learning disabilities and neurodegenerative diseases

SYLLABUS OF DSE-10

BCH-DSE-10:

NEUROBIOLOGY

Semester – VII

Theory

Credits: 2 **Total Hours: 30**

UNIT 1: Introduction and Anatomy of nervous system **No of classes 5**

Understanding structural hierarchy in the nervous system. Cells of the nervous system: classification; Neuroglia and their function; Neuron and structure; Structure of nerve; Neural growth; Blood Brain Barrier; Formation and composition of cerebrospinal fluid; Introduction to neuroanatomy: Neural meninges, Brain stem, cerebellum, limbic system and cerebral cortex; Spinal cord.

UNIT 2: Neurochemistry **No of classes 10**

Neuron as an excitable cell: resting membrane potential, ion channels, generation of action potential, graded and spike potentials, patch clamp technique; the Synapse: electrical and chemical synapse, Synaptic neurotransmitter release, synaptic plasticity; Neurotransmitter: Structural and molecular mechanisms of acetylcholine, catecholamines, serotonin, glutamate, glycine, histamine
, GABA, neuropeptides like PYY, enkephalins, endorphins, substance P, orexin and anorexic peptides; Neurotransmitter receptors: metabotropic and ionotropic; saltatory conduction and axonal transport.

UNIT 3: Neurophysiology **No of classes 7**

The concept of neural circuits and neuronal pools. Introduction to sensory perception, sensory receptor types and somatosensory pathway; Perception of touch and pain; Perception of

chemical senses: taste and smell; Autonomic nervous system: sympathetic and parasympathetic; Somatic nervous system: reflex arc and neuromuscular junction.

UNIT 4: Neural processes and Neurodegenerative diseases No of classes 8

Circadian rhythm, EEG and sleep; Memory: Types. memory loss, LTP and learning, learning disabilities, aphasias, Emotional and motivational conditioning in neural responses; Neurodegenerative disorders- Parkinson's disorder; Neurochemical basis of drug abuse.

2.3 Practical:

Credit: 2 Total Hours: 60

1. To make a temporary mount of a neuron.
2. Virtual laboratory on patch clamp.
3. Acetylcholinesterase assay in different brain areas.
4. Assay of a neurotransmitter (catecholamines)
5. Study of sensation of touch smell and taste, understanding desensitization and adaptation.
6. Reflex arc through knee jerk assay
7. Understanding EEG and case studies on sleep, epilepsy and mood disorders.
8. Drosophila/ zebrafish behavioral experiment.
9. Case studies on learning disabilities, neurodegenerative disease, autism spectrum disorders and schizophrenia.
10. Field trip to see EEG and fMRI.

Suggested reading:

1. Medical Neurobiology (2011) 1st ed., Peggy Mason, Oxford University press, ISBN-13: 978- 0195339970.
2. Principles of Neural Science (2000) 4th ed., Eric R Kandel, James H Schwartz & Thomas M Jessell, McGraw Hill (USA), ISBN: 0-07-112000-9.
3. Clinical Neuroanatomy and Neuroscience (2012) 6th ed., M J Turlough Fitzgerald, Gregory Gruener & Estomih Mtui, Elsevier, ISBN: 978-0-7020-4042-9. Bijlani, Guyton

3. Teaching Learning Process and Assessment Methods

Facilitating the Achievement of Course Learning

Outcomes**

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I	The students will be able to learn the anatomy and physiological roles of cells of the nervous system. They would gain the knowledge about the importance of cerebrospinal fluid and Blood Brain Barrier	Teaching will be conducted both through black board mode and power point presentation mode Students would also learn concepts by conducting lab practicals.	Students will be assessed through the assignment and tests Lab skills will be tested
II	Students would be able to understand the concept of nerve action potential, its generation and importance. They will also learn about the role of synapse and the importance of chemicals in neural signaling.	Teaching will be conducted both through black board mode and power point presentation mode Students would also learn concepts by conducting lab practicals.	Students will be assessed through the assignment and tests. MCQs will also be given to assess the understanding of few concepts

			Lab skills will be tested
III	Students will learn about the concept of neuronal circuits and neuronal pools.They will also learn about the different perceptions including pain, touch, smell and taste	Teaching will be conducted both through black board mode and power point presentation mode Videos to demonstrate various	Students will be assessed through the assignment and tests. MCQs will also be given to assess the understanding of few concepts

		perceptions will be shown to students to understand the theoretical concept Students would also learn concepts by conducting lab practicals. Field visit will help them get an experiential training in the method used in reading brain function like fMRI and EEG. analysis of such data with discussions will help them understand concepts better.	Lab skills will be tested Data obtained from experiments like maze tests and sensory perception tests and other related topics can be presented and discussions conducted.
IV	The students will learn about various neural processes including memory and learning. They will also get to know about the physiology of some of the common neurodegenerative disorders	Teaching will be conducted both through black board mode, power point presentation mode as well as by demonstrating the experiment. Students would also learn concepts by conducting lab practicals.	Students will be assessed through the assignment and tests case studies discussions will make them understand the neurophysiological aspects of neurodegenerative and other neurological diseases better.

(Assessment tasks enlisted here are indicative in nature)**

Keywords

Brain anatomy, cerebrospinal fluid, neurochemistry, saltatory conduction, sensory perception, reflex reactions, sleep, memory and learning, mood and neurological disorders