Optional Course

TOPICS IN NEUROSCIENCE (LS640A)

S K Jha

S. No.	Topics	Lectures
1.	Neuroanatomy - Organization of neurons – cytoarchitecture. Functional organization, Ascending and descending tracts, cerebrum, cerebellum, brainstem, Spinal cord,	3
2.	Intra and Inter-neuronal communication, Neurotransmitter synthesis and regulation Release of neurotransmitter and its action Axoplasmic transport, Receptor, signal transduction, Second Messenger, Neural regulation of complex functions, e.g., sensation - modalities, pain, touch,	4
3.	Special senses - vision and hearing Neural regulation of cardiovascular and respiratory systems	4
4.	Sleep-wakefulness – Mechanism, Neural and Chemical regulations, Functions of Sleep and REM Sleep; various hypotheses, Sleep, loss and sleep disorders, Insomnia, REM sleep behavior disorders, Narcolepsy, Sleep apnea, etc	2
5.	Learning and memory, commonly studied types of memories and their molecular basis	1
6.	Neurons & Glia: Components and classification of neurons and Glia, Nissl and Golgi stains, Cell-specific markers for neurons and Glia. Different types of neurons and Glia. Astrocytes, oligodendrocytes, and Schwann cells, types of astrocytes--type-I, II astrocytes, fibrous and protoplasmic astrocytes, functions of other glial cells: Oligodendrocytes and microglial cells.	3
7.	Molecular structure of synapse and neuromuscular junction: Overview of the central nervous system (CNS) synapse and NMJ, Kinds of CNS synapses, Molecular components of the synaptic junction, Presynaptic and post-synaptic specialization, Molecular structure of neuromuscular junctions: Composition and properties of AChR, Development of NMJ, Signaling mechanism of AChR clustering.	3
8.	The Cellular and molecular basis of neural development: Neural induction, Polarity, and segmentation, The generation of neurons and Glia, Migration of neurons in the CNS. Determination of neural and glial cell identity, Axon outgrowth, Axon guidance, Target Selection, Naturally-occurring neuron death, Synapse formation, and function. Refinement of synaptic connections.	3
9.	Growth factors and survival of neurons: Transcription factors gradients –regional differentiation, Cell death & neurotrophic hypothesis, Neurotrophins family and its receptors, Cytokines, and growth factors in the nervous system, competitive	3

	interactions during development. Functions in neuronal PCD.	
10.	Neuroimmunological and neurodevelopmental disorders: Brain inflammation: the role of astrocytes and microglia, Multiplesclerosis, NeuroAIDS. Cerebral palsy, autism. Neurological disorders: Parkinson, Epilepsy, Alzheimers	3

Suggested Reading :

1. Principles of Neural Science by Eric R. Kandel, James Harris Schwartz, Thomas M. Jessell
2. Fundamental Neuroscience by Larry R. Squire
3. The Central Nervous System: Structure and function by Per Brodal
4. From Neuron to Brain by John G. Nicholls, A. Robert Martin, Bruce G. Wallace, Paul A. Fuchs.
5. Development of the Nervous system by Dan H. Sans, Thomas A. Reh, William A. Harris.