PSY-414: Cognitive Neuroscience (3 CHs)

Pre-requisite: None

Course Description:

This course explores the cognitive and neural processes that support attention, vision, language, motor control, navigation, and memory etc. It introduces basic neuroanatomy, functional imaging techniques, and behavioral measures of cognition, and discusses methods by which inferences about the brain bases of cognition are made. We consider evidence from patients with neurological diseases (Alzheimer's disease, Parkinson's disease, Huntington's disease, Balint's syndrome, amnesia, and focal lesions from stroke) and from normal human participants.

Course Objectives:

This course will facilitate students to:

- To explain and discuss functional neuroanatomy of the human brain.
- To provide students with an understanding of how research in cognitive neuroscience has informed our understanding of the cognitive processes engaged by the brain.
- To understand various neuroimaging methods used in cognitive neuroscience studies such as functional Magnetic Resonance Imaging (fMRI), electroencephalography (EEG), and transcranial magnetic stimulation (TMS).
- To demonstrate how contemporary human intelligence-based technologies (i.e. Machine Learning, Natural Language Processing, Deep Learning, Robotics, Augmented Intelligence etc.) use cognitive neuroscience research.
- To discuss case studies of brain-damaged individuals informing the neurological underpinnings of various disorders.

Course Learning Outcomes:

At the end of this course, students will be able to:

- Understand the broad functional neuroanatomy of the human brain.
- Apply the knowledge acquired from the latest research in cognitive neuroscience.

- To examine research investigating the neurological basis of behavior.
- To analyze assessment of cognitive functions through various imaging methods.
- To Understand and analyze cognitive impairments and neuropsychological disorders following brain damage.
- To evaluate the usefulness and appropriateness of the use of cognitive neuroscience in contemporary human intelligence-based technologies.

Course Contents:

- Introduction to Cognitive Neuroscience: Scope, Brain-Behavior Relationships, and Current Trajectories in Neuroscience.
- Measurement Tools in Neuroscience: Neuroimaging Methods in Cognitive Neuroscience
- Hemispheric Asymmetry
- Auditory and Visual Perception
- Attention and Object Recognition
- Brain Circuits over a Lifetime: A Lifespan Perspective on Human Neurocognitive Plasticity
- Brain Circuits Over a Lifetime: Brain Maintenance and Cognition Throughout the Lifespan
- Mental Imagery and Mental Imagery Therapy
- Memory, Working Memory and Control Processes
- Motor Control
- Intention, Action, Control: Taking the Example of The Neuroscience Of Brain-Machine Interfaces
- Cognitive Neuroscience and Contemporary Human Intelligence-Based Technologies
- Law And Neuroscience: Progress, Promise, and Pitfalls

Textbooks:

- Poeppel, D., Mangun, G. R., & Gazzaniga, M. S. (Eds.). (2020). The cognitive neurosciences. MIT Press

- Gazzaniga, M., Ivry, R.B.,& Mangun, G.R. (2013). Cognitive Neuroscience: The Biology of the Mind (4th edition). New York, NY: W.W. Norton & Co. (ISBN-13: 978-0-393-91348-4).