

## PEI204: COGNITIVE ENGINEERING

L	T	P	Cr
3	1	0	3.5

**Course Objectives:** To understand the concepts of Cognitive Neuroscience, to enable design experiments related to Cognitive Engineering

**Overview of Nervous System:** Cellular components of Nervous system; Organizational Principles of Neural System: Organelles and Their Functions; Membrane Potential and Action Potential; Synaptic transmission and Cellular signaling (Basic Neurochemistry)

**Introduction to Cognitive Neuroscience:** General Introduction and philosophy of Mind; Cellular/Molecular Basis of Cognition; Visual perception and Object recognition; Spatial Processing and Attention; Concept Formation, Logic and Decision Making; Problem Solving, Creativity and Intelligence; Learning Memory (I)- Memory Models and Short Term Memory; Learning Memory (II)- Long term potentiation and Long Term Memory

**Psychophysiology:** Tools of physiology - experimental approach; Electroencephalography for cognitive perspectives; Event related potentials (ERP) for cognitive events; Electrodermal Activity (EDA) and Cardiovascular psychophysiology; Polysomnography for Sleep research

**Functional neuro-imaging of cognition and Image processing:** PET(Positron Emission Tomography); Concepts of NMR (Nuclear Magnetic Resonance) and fMRI (Functional MRI); DTI(Diffusion Tensor Imaging); Image processing for brain functioning

**Signal Processing and Neural engineering:** Physiological signals– Generation and Sensing; Bio-signal acquisition; Data pre-processing; Feature Extraction; Applications:-Brain Computer Interface and Neuro-feedback

**Research methodology:** Designing an experiment; Issues in Human research and Ethics; Statistical data analysis

### **Minor Project (if any):**

Development of cognitive assessment techniques around PEBL

**Course learning outcome (CLO):** After the completion of the course the students will be able to

1. Acquire basic knowledge of cognitive neuroscience.

Acquire basic knowledge of psychophysiology

Acquire basic knowledge of functional neuro-imaging of cognition and image processing

Use signal processing and neural engineering in relation to cognitive engineering.

Design experiments related to cognitive engineering

**Recommended Books:**

1. *Dale Purves, Neuroscience, Sinauer Associates, Inc (2001)*
2. *Handbook of Psychophysiology, Cambridge University Press (Third Edition)(2007)*
3. *Michael S. Gazzaniga, The Cognitive Neurosciences, (Fourth Edition) MIT, (2009)*
4. *Robert L. Solso, Otto H. MacLin, M. Kimberly MacLin, Cognitive Psychology (Eighth Edition), Pearson (2007)*
5. *PetterLaake, Haakon BreienBenestad, Research Methodology in the Medical and Biological Sciences, Academic Press (2007)*

**Evaluation Scheme:**

S.No	Evaluation Elements	Weightage (%)
1.	MST	30
	EST	45
	Sessionals (May include Assignments/ Projects/ Tutorials/ Quizes/ Lab Evaluations)	25