

## PEI204: COGNITIVE ENGINEERING

L	T	P	Cr
3	0	0	3.0

**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 signalling (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

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

1. Acquire basic knowledge of cognitive neuroscience.
2. Acquire basic knowledge of psychophysiology
3. Acquire basic knowledge of functional neuro-imaging of cognition and image processing
4. Apply signal processing and neural engineering in relation to cognitive engineering.
5. *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:**

Evaluation Elements	Weightage (%)
MST	30
EST	50
Sessionals (May include Assignments/ Projects/ Tutorials/ Quizes/ Lab Evaluations)	20