

Cognitive Science

Course Title: Cognitive Science
Course No: CSC374
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:

This course covers the fundamental concepts of cognitive science and brain computation.

Course Objectives:

The main objective of this course is to provide basic knowledge of web cognition process, mind theory, physical symbol systems, cognitive systems, concepts of brain mappings and neural network structures.

Course Contents:

Unit 1: Introduction (7 Hrs.)

Cognition Process, Cognitive Psychology, Cognitive Science; Foundations of Cognitive Science, Cognitive Science and Multi-disciplinary; Machines and Minds; Laws thoughts to binary logic; Classical Cognitive Science; Connectionist Cognitive Science; Mind body Problem; Turing Response to Mind Body Problem; Pinker, Pengerose and Searle's Responses to Mind Body Problem; Representational Theory of Mind; Theories of Mental Representation: Minimal Analysis of mental representation, Resemblance theories of mental representation, Casual covariation theories of mental representation, internal roles theories of mental representation

Unit 2: Precursors of Cognitive Science (5 Hrs.)

Behaviorism; Theory of Computation and Algorithms; Algorithms and Turing Machines; Marr's Three Level of Computation; Linguistics and Formal Language; Information Processing Models in Psychology

Unit 3: Psychological Perspective of Cognition (5 Hrs)

Cognitive Models of Memory, Atkinson-Shiffrin's Model, Tulving's Model, Mental Imagery, Kosslyn's View, Moyer's View, Peterson's View, Cognitive Maps, Problem Understanding, States of Cognition, Cognition in AI

Unit 4: Physical Symbol System and Language of Thought (7 Hrs.)

Physical Symbol System Hypothesis; Symbol and Symbol Systems; Problem Solving by Symbol Structure; Physical Symbol System to Language of Thoughts; The Computer Model of the Mind; Syntax and the Language of Thought: Fodor's Argument for the Language of Thought Hypothesis; The Chinese Room Argument; Chinese Room and Turing Test; The Symbol Ground Problem

Unit 5: Cognitive System (4 Hrs.)

Cognitive System; Architecture for intelligent agents; Modularity of Mind; Modularity Hypothesis; The ACT-R/PM architecture

Unit 6: Brain Mapping (6 Hrs.)

Structure and Function in Brain; Anatomical Connectivity; Cognitive Functioning Techniques from Neuroscience; Mapping the brain's electrical activity: EEG and MEG; Mapping the brain's blood flow and blood oxygen levels: PET and fMRI; Attention; Visuospatial attention

Unit 7: Mind Reading (5 Hrs.)

Metarepresentation; Metarepresentation, autism, and theory of mind; Mind Reading System; Understanding False Belief; Mind Reading as Simulation

Unit 8: Neural Networks and Distributed Information Processing (6 Hrs.)

Neurally Inspired Models of Information Processing; Single-Layer Networks and Boolean Functions; Multilayer Networks; Information Processing in Neural Networks; Language Learning in Neural Networks; Neural Network Models of Children's Physical Reasoning

Laboratory Works:

The laboratory work includes implementing and simulating the concepts of cognition process, intelligent agents, neural networks. In addition, laboratory work can be extended to use the tools like PSY Toolkit, PsyNeuLink etc.

Text Book / Reference Books:

1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, Cambridge University Press
2. Michael R. W. Dawson , Mind, Body, World: Foundations of Cognitive Science, UBC Press
3. Daniel Kolak, William Hirstein, Peter Mandik, Jonathan Waskan, Cognitive Science, An Introduction to Mind and Brain, Routledge Taylor and Francis Group
4. Amit Konar – Artificial Intelligence and Soft computing: Behavioral and Cognitive Modeling of the Human Brain, CRC Press