

Devi Ahilya University, Indore, India Institute of Engineering & Technology				III Year B.E. (Electronics & Instrumentation Engg.)			
Subject Code & Name	Instructions Hours per Week			Credits			
EIR5E4	L	T	P	L	T	P	Total
Fuzzy Logic and Neural network	3	1	2	3	1	1	5
Duration of Theory Paper: 3 Hours							

Prerequisite: Students should have knowledge of fundamentals of set theory, control systems and networks.

Rationale: This course introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks. Also deals with Associate Memories and introduces Fuzzy sets and Fuzzy Logic system components. The Neural Network and Fuzzy Network system application to Engineering is also presented.

Unit 1:

Introduction to classical sets – properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzy Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

Unit 2:

Introduction to Neural Networks, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Unit 3:

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

Unit 4 :

Single Layer Feed Forward Neural Networks : Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.
Multilayer Feed forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Unit 5 :

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network Neural network applications: Process

identification, control, fault diagnosis and load forecasting.

Reference Books:

1. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
2. Neural Networks – Simon Hakins , Pearson Education
3. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
4. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.

Course Outcome:

After learning the course the students should be able to:

1. Apply the concept of fuzziness involved in various systems.
2. Apply the knowledge of fuzzy set theory.
3. Design fuzzy logic control and adaptive fuzzy logic and using algorithms.
4. Apply knowledge of application of fuzzy logic control to real time systems..